The Electrical Industry's Weekly Magazine

July 25, 1960

Electrical World

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CIGRE CONFERENCE AT PARIS

shows need for higher capacity in transmission lines, cables, and apparatus ... p. 45

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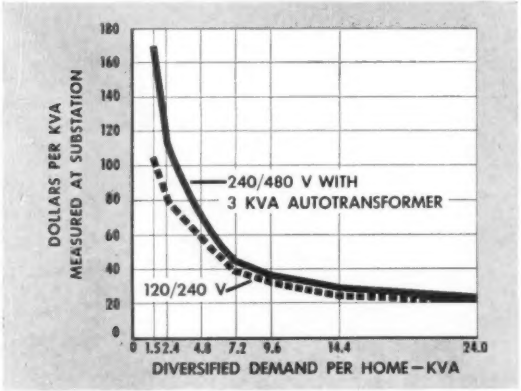
Distribution economies explored by computer:

25,000 Systems Designed in 2½ Hours

CONTRIBUTORS to the study are, left to right, H. E. Campbell, M. W. Gangel, R. C. Ender, V. C. Talley, all of General Electric's Electric Utility Engineering Section.



LOWER COST of the 120/240 v secondary system from feed point through meter is illustrated by this chart. Cost curves are based on 140 ft. secondary spans, 6750 kva load per feeder, and 12.47 kv primary.

CONTROLLING THE COSTS of an expanding residential power distribution system is one of the most complex problems faced by an electric utility today. To supplement the work of utilities in this area, General Electric engineers recently used a digital computer to calculate 25,000 combinations of the many cost factors involved. Their report, which analyzes these data, was presented at the winter general meeting of the AIEE.

SOME INPUT ELEMENTS supplied to the computer for its 2½-hour run were primary voltages of 4.16 kv and 12.47 kv, secondary voltages of 120/240 v and 240/480 v single phase, feeder loads, number of customers per transformer, number and sizes of primary mains and laterals, sizes and lengths of secondary conductors, voltage drops, and sizes and loadings of distribution transformers.

CONCLUSIONS of the study include the following:

- The 120/240 v linear coverage overhead secondary system is generally more economical than the 240/480 v system when served by a 4.16 kv or 12.47 kv primary.
- Except for the lighter customer demands supplied by a 4.16 kv primary, it is economical to load the primary feeders to the maximum levels considered in the study: 3000 kva at 4.16 kv and 9000 kva at 12.47 kv.
- For residential load levels within the range of 1.5—24.0 kva, a primary voltage of 12.47 kv costs less than 4.16 kv in areas of new construction.
- The system designed at the lowest cost does not necessarily use the entire available voltage spread. This is particularly true at the higher customer loads.
- A single secondary conductor size will economically serve a wide range of loads. Conductor sizes as large as 397.5 MCM Al can be justified at the larger loads considered.

A GROWING POPULATION and a rising standard of living call for a rapidly accelerating expansion of distribution capacity. This study indicates that the search for the most economical expansion pattern is greatly facilitated by the use of digital computers. For a copy of the report or for information about applying this study's techniques to an analysis of your own distribution system, write Section 604-01, General Electric Company, Schenectady, N.Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 154, No. 4 JULY 25, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electrical power

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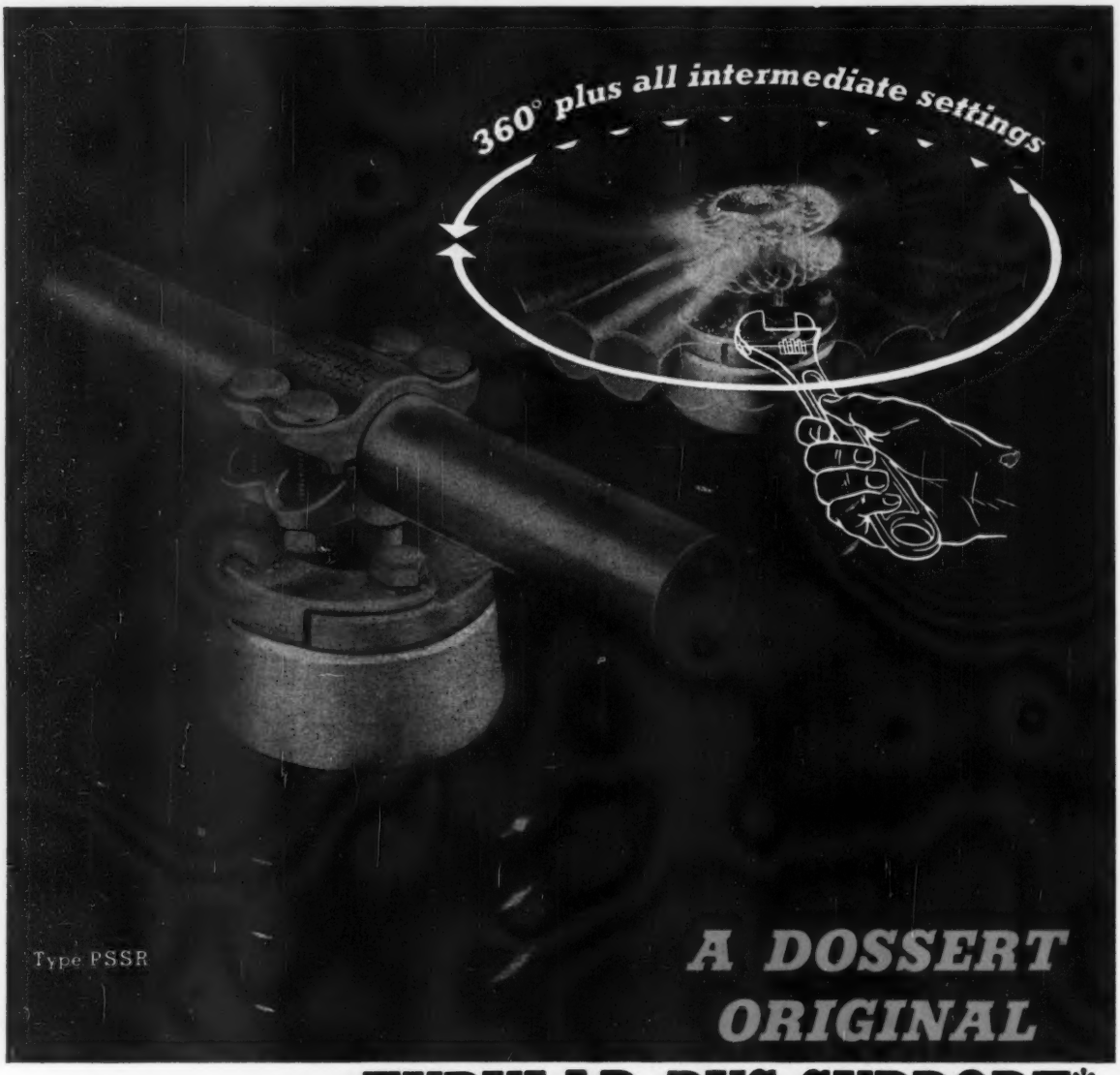

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LETTERS

Compliments to Baltimore G&E

To the Editor:

My compliments to you on your forward-looking editorial in the July 4 issue on "Higher Service Voltage Goes on Trial." Your comments were very much to the point.

The Baltimore Gas & Electric Co is certainly to be commended for taking the initiative and installing a trial 240/480-v secondary system. The whole industry will benefit from the information obtained from this trial installation.

David Burns, Chief
Transmission & Distribution Div
The Detroit Edison Co
Detroit 26, Michigan

Why Not Visit Belgium?

To the Editor:

. . . I was very much surprised that Belgium was not among the countries that your special correspondent was able to visit on his recent tour.

We should have been very glad to have met Dan Braymer in Brussels and I am sure he would have been interested by the recent achievements of the Belgian electricity industry.

As you intend to reinforce contacts with Europe, I am sure we shall have sooner or later the opportunity to get in touch.

R. Paquet
Federation Professionnelle des
Producteurs et Distributeurs
D'Electricite de Belgique
31 rue Belliard, Brussels

▶ *A very tight travel schedule, the two world power meetings, and previous coverage of Belgian activities forced Braymer to drop Belgium from his flying itinerary. We had excellent coverage of the A.I.M. transmission meeting in Brussels the previous month (EW, May 30, p 28) and have had the opportunity over past years of meeting some of your representatives on their trips to the US. We would certainly hope that Belgium will be the first stop the next time one of our editors sets out for Europe.*

Cost of Capital—Of Major Importance

To the Editor:

I should like to express my appreciation for the way in which my talk on cost of capital was summarized in the Management Newsletter (EW, July 4, p 69). William Burke did an extremely competent and comprehensive job.

The subject is certainly one of major importance to all electric utility companies and I would expect a lot of interest in it to be shown.

Charles Tatham
Research Dept, Bache & Co
New York 5, N. Y.

The outer low-voltage coil of copper strip being wound. The "progressive" coil winding method uses a low-high-low coil grouping, and the flat copper leads from the inner low-voltage coil, also of copper strip, can be seen just above the shaft. Note paper, with resin applied "barber-pole" fashion, being fed in below copper strip. As both high- and low-voltage coils use the same electrical centers, the winding has better electrical balance and inherently higher resistance to short-circuit forces.

Strip-copper transformer windings help improve performance—cut size and weight

New coil designs using copper strip have helped extend the range of pole-mounted distribution transformers through 500 Kva—and to shrink miniature transformers for electronic use by 1/3 in size and weight. In both cases, operating characteristics were improved at the same time.

WESTINGHOUSE ELECTRIC CORP. has made the significant advance in the distribution transformer field through a combination of new coil and core design. For ratings of 75 Kva through 500 Kva, the company devised the new "progressive" winding method. Using a low-high-low coil grouping, individual coils are wound one on top of the other, with the required amount of epoxy-resin-coated paper insulation wound between layers and coil groupings. The inner and outer low-voltage coils are wound with strip copper the full width of the wire space. High-voltage windings are simple layer-wound coils of rectangular wire. All elements are wound with carefully controlled tension to produce a tight, solid coil.

During subsequent drying and vacuum treatment, the epoxy resin on the paper is bonded to the strip copper and the coil layers. The entire winding becomes a rigid, self-supporting structure, with strength to withstand high short-circuit stresses. Hence external coil bracing, an important weight and space factor in previous design, is completely eliminated. The new windings make a notable contribution (about 9% for the 167 Kva unit) to the total weight reduction.

Anaconda technical specialists worked closely with Westinghouse engineers during the development of the "progressive" winding method and The American Brass Company is supplying high-quality copper strip, deburred, and finished to half commercial tolerances in width and gage. It also designed special packaging to protect the strip during shipment and in handling.

AT THE OTHER END OF THE SCALE, extremely thin gage copper strip or foil has helped to miniaturize transformers to the level of other electronic system components. Because of its high electrical conductivity, and optimum stacking factor, the copper strip can be wound into extremely compact ribbon-type wafer coils that reduce the weight and volume of transformers about one-third.

TECHNICAL ASSISTANCE. Whatever the application, if you are investigating the advantages of winding coils with copper strip or "Electro-Sheet" electro-deposited copper foil, metallurgists and technical specialists of The American Brass Company are available to work with you in selecting the proper materials, including coatings, in the lamination of insulations. For such assistance see your American Brass representative, or write: The American Brass Company, Waterbury 20, Conn. 6074

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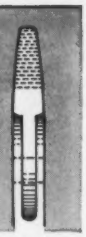

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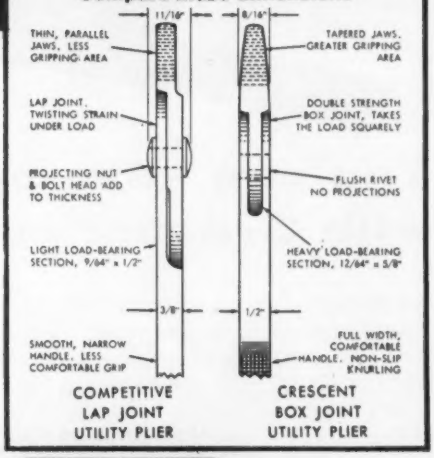
11/16"
8/16"
THIN, PARALLEL JAWS, LESS GRIPPING AREA
TAPERED JAWS, GREATER GRIPPING AREA
LAP JOINT, TWISTING STRAIN UNDER LOAD
DOUBLE STRENGTH BOX JOINT, TAKES THE LOAD SQUARELY
PROJECTING NUT & BOLT HEAD ADD TO THICKNESS
FLUSH RIVET NO PROJECTIONS
LIGHT LOAD-BEARING SECTION, 9/64" x 1/2"
HEAVY LOAD-BEARING SECTION, 12/64" x 5/8"
3/8"
1/2"
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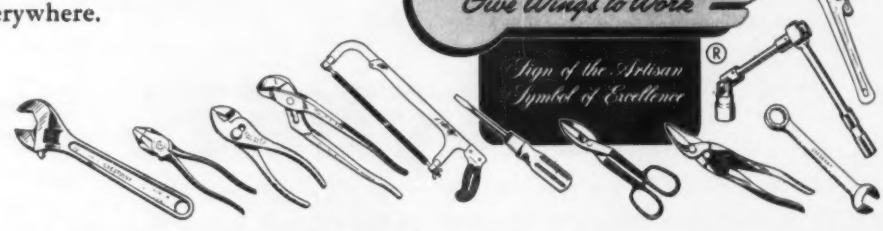

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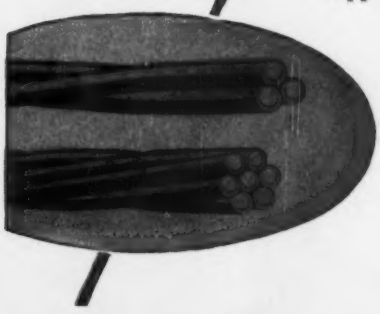

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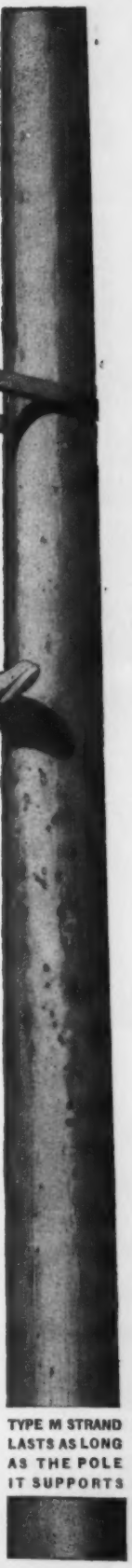

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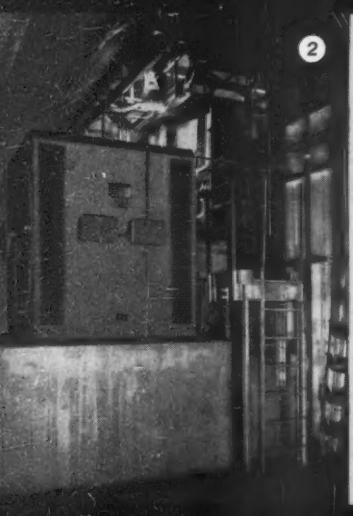


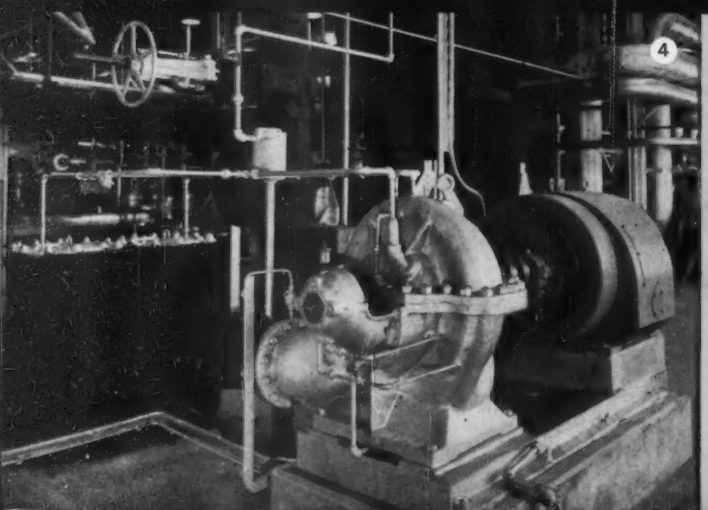
1. Twin 600-hp, 225-rpm vertical Elliott motors drive condenser circulating water pumps rated 84,000 gpm each at 25-ft total dynamic head. Pumps are located in screen house on Lake Erie shore.

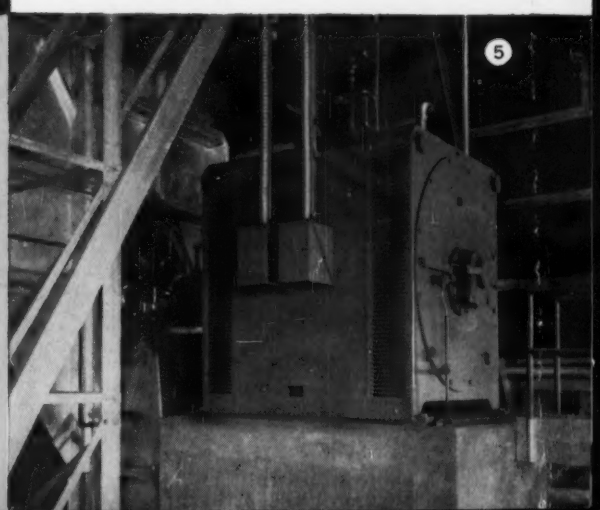
2. (Far Left) One of the two 1750-1250-hp, 890/710-rpm Elliott induction motors that power the two forced-draft fans, each with capacity to move 370,000 cfm of air.

3. (Near Left) Four vertical single-stage water-cooled boiler circulating pumps deliver water at 6480 gpm driven by 300-hp, 1800-rpm vertical Elliott motors. Water is pumped to four drums, mounted on furnaces.

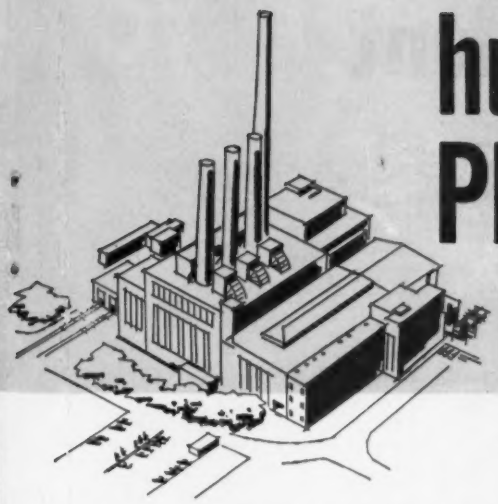
4. (Lower left) Elliott twin strainer and 300-hp motor serve this sluice water pump in supplying water to ash hopper for quenching red-hot ash.

5. (Below) One of two 456,000-cfm induced-draft fans driven by 2250/1750-hp, 705/585-rpm Elliott induction motors.





Elliott Motors drive auxiliaries in huge CEI Ashtabula Plant Extension



The addition of Unit No. 5 doubles the capacity of Cleveland Electric Illuminating Company's Ashtabula Power Plant. Here twenty-seven Elliott motors in sizes from 25 hp to 4000 hp drive all major auxiliaries. With few exceptions, all motors are squirrel-cage induction type with open dripproof enclosures and Class "A" insulation. Motors of 250 hp and above are three-phase, 4000-volt class and are equipped with thermocouples for automatic temperature scanners. Each motor has been carefully coordinated with its driven equipment to assure maximum reliability and overall economy.

6. In the photograph below are shown four sizes of Elliott motors which provide pumping and pulverizing power in CEI's Ashtabula Unit 5. At right, pair of 450-hp, 1200-rpm vertical motors power the condensate pumps. Trio of 4000-hp, 3600-rpm induction motors power boiler-feed pumps, background. Just visible, extreme center background, is one of eight motors driving coal pulverizer mills. Left foreground shows three of four Elliott units powering high-pressure heater drain pumps.

ELLIOTT
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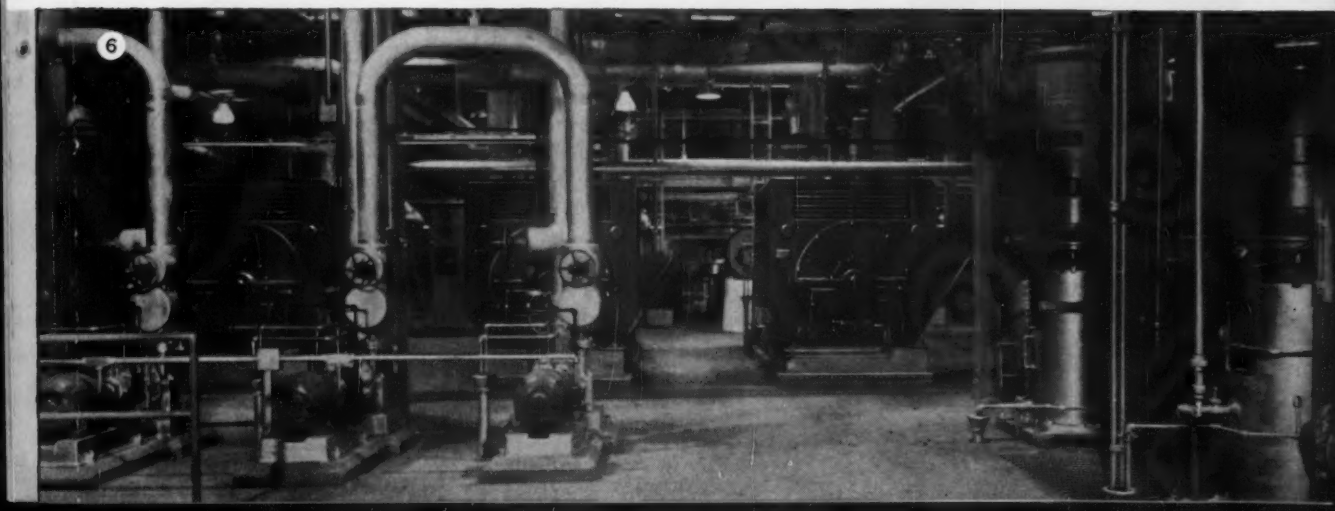

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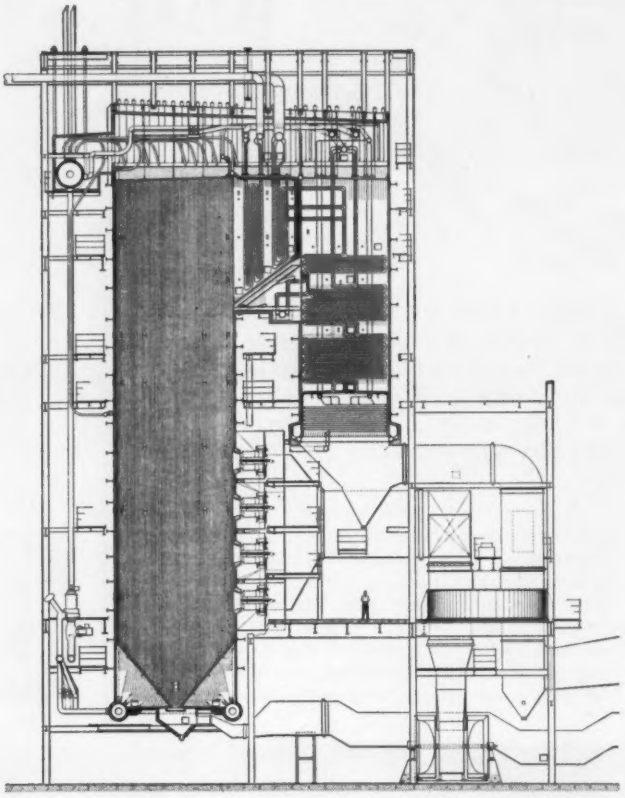
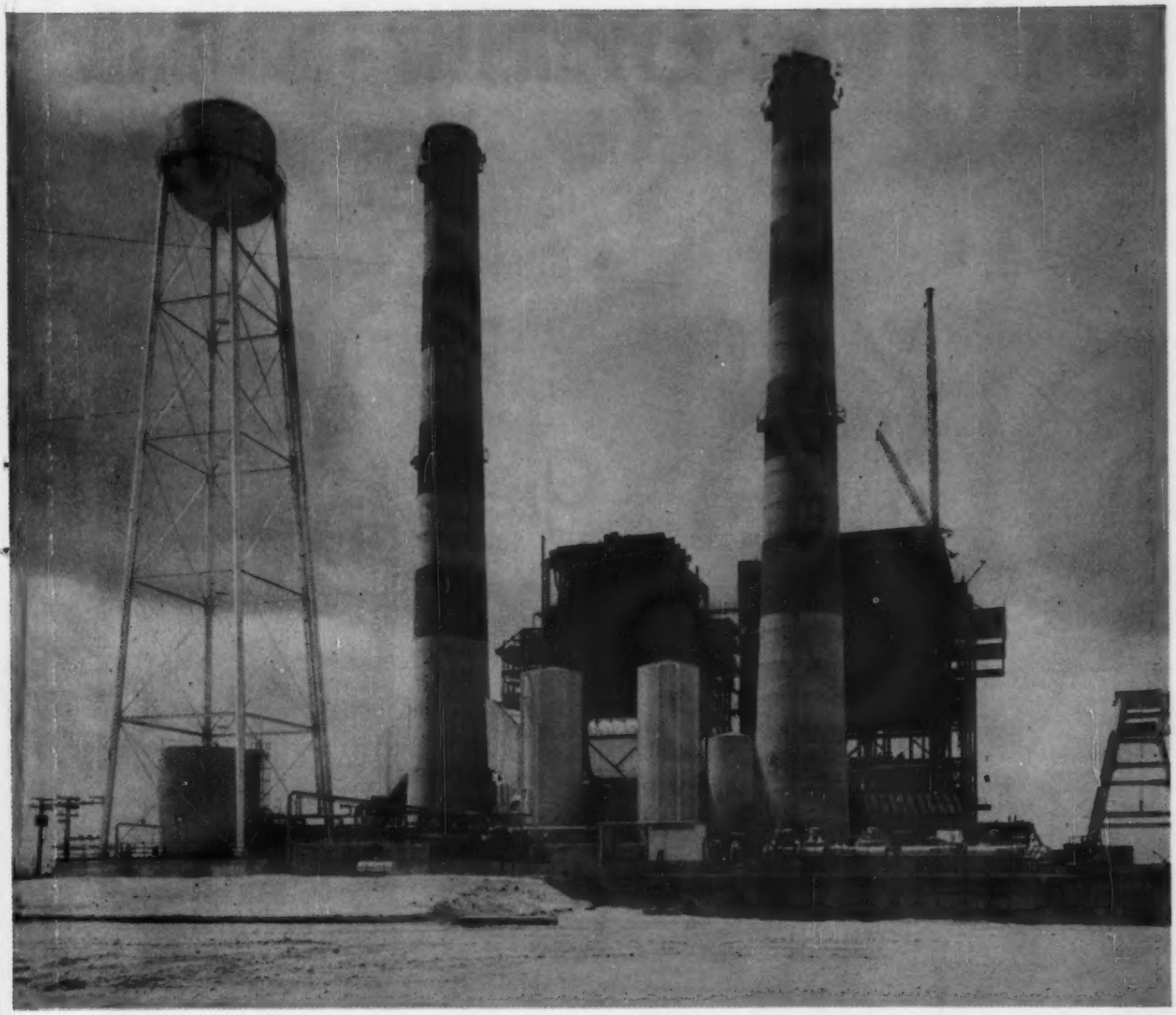
Port Everglades

New Port Everglades power plant *Goes into Service*



The C-E unit shown above—one of two duplicates—is now in service at the Port Everglades Power Plant of Florida Power & Light Company. Each of these units is designed to serve a 240,000-kw turbine-generator operating at a throttle pressure of 2000 psi with a primary steam temperature of 1005 F, reheated to 1005 F. They are of the controlled-circulation, radiant reheat type with divided furnaces. The reheater surface is located between the finishing superheater and the primary superheater surface in the rear pass. Economizer surface is below the primary superheater and regenerative air heaters follow the economizer. The units are oil fired using C-E Horizontal Type R Burners.



With the recent starting-up of the first unit in their new Port Everglades Power Plant, Florida Power & Light Company has made a noteworthy addition to their rapidly expanding power system. The new unit, one of two duplicates, is rated at a capacity of 240,000 kw, making it the largest in the state.

The new plant is strategically located where the robust growth of Florida's Lower East Coast pointed up the need for additional power. The availability of unlimited water supply and accessibility to tanker supply of fuel oil made Port Everglades a natural choice. The Bechtel Corporation is the consulting engineer.

The addition of these units at Port Everglades will bring the total generating capability of the Florida Power & Light system to 2,128,000 kilowatts, a fantastic increase of 380% since 1949. Such has been the demand of Florida's phenomenal growth.

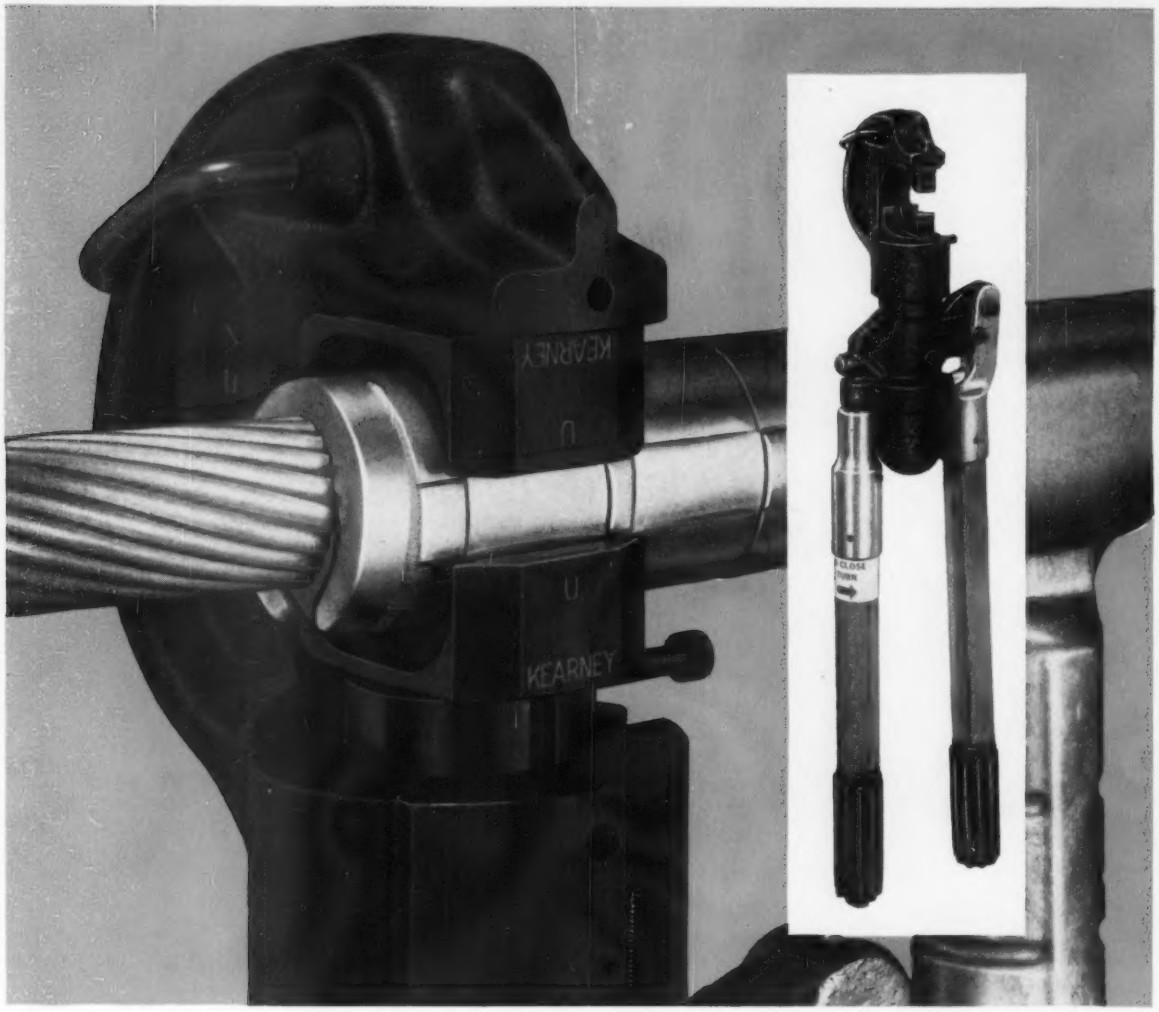
Steam for the new turbine-generator now in service, as well as its duplicate now under construction, is supplied by C-E Controlled Circulation Boilers, a cross-sectional elevation and brief description of which appear on the opposite page.

COMBUSTION CE **ENGINEERING**

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y. C-287

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

KEARNEY WH-2 HYDRAULIC TOOL AND



This is the tool... Kearney does it again! The Kearney WH-2 Hydraulic Tool—big brother to the WH-1 Tool—is the FIRST and ONLY portable, hand-operated, hot-line compression tool to accommodate such a wide range of fitting and conductor sizes. Equipped with only this ONE tool linemen can now install tap compression connectors on all sizes of energized and non-energized conductors from #6 Solid through 636 MCM ACSR! Die sizes are the same as those for the Kearney WH-1 Tool, plus the additional sizes required to install the larger fittings shown on the opposite page. Dies snap in or out easily . . . can be secured with a set-screw. A two-step, high speed pump generates full 21,000 pounds of thrust. An automatic overload valve prevents over-compression. Large C-frame head allows clear view of work area while making indents. A partial rotation of one handle sets tool to compress or retract dies—no need to remove either hand from handles. Interchangeable insulated handles are available in various lengths to adapt tool to individual voltage requirements.

For further information, contact your Kearney

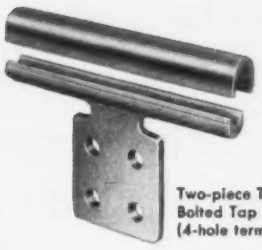
509

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH, IOWA

2-PIECE COMPRESSION CONNECTORS

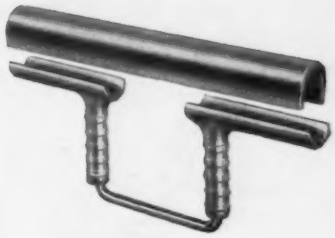
. . . extend the connection range to include installations on all "Hot" or "Cold" lines from #6 Solid to 636 MCM ACSR

Two-piece L-Squeezon Tap Connector

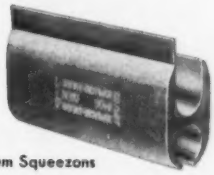


Two-piece T-Squeezon Bolted Tap Connector (4-hole terminal pad)

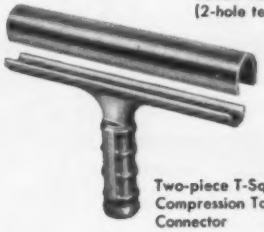
Two-piece T-Squeezon Bolted Tap Connector (2-hole terminal pad)



Two-piece L-Squeezon Hot Line Stirrup

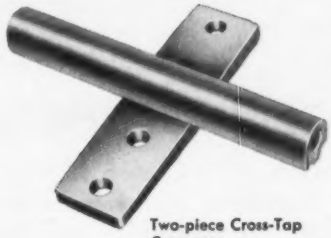


Aluminum Squeezons



Two-piece T-Squeezon Compression Tap Connector

Cast Aluminum Terminals (2 and 4-hole pad)



Two-piece Cross-Tap Connector

Two-piece Repair Sleeve

These are the fittings . . . New, larger Kearney tap connectors and the Kearney WH-2 Hydraulic Tool now extend the tap compression connection range to include installations of highest electrical efficiency on energized or non-energized conductors as large as 636 MCM ACSR. Kearney two-piece aluminum tap connectors accommodate large conductor sizes from 266.8 MCM through 636 MCM ACSR. Tap units slide into and interlock with an encircling sleeve unit. Sleeve for any one conductor size will accept interchangeably various tap units of the same size range. Kearney interlock design aids installation . . . insures uniform compression and full-circumference contact . . . eliminates strand cutting. Sufficient connector mass without excess weight assures cool-running connections. Interchangeability of tap units helps reduce storekeeper inventories.

Also illustrated: Kearney Cast Aluminum Terminals, accommodating wire sizes from #2 ACSR to 1000 MCM Str.; Aluminum Squeezons for wire sizes from #6 Solid to 397.5, line or tap.

sales representative . . .

KEARNEY

JAMES R. KEARNEY CORPORATION

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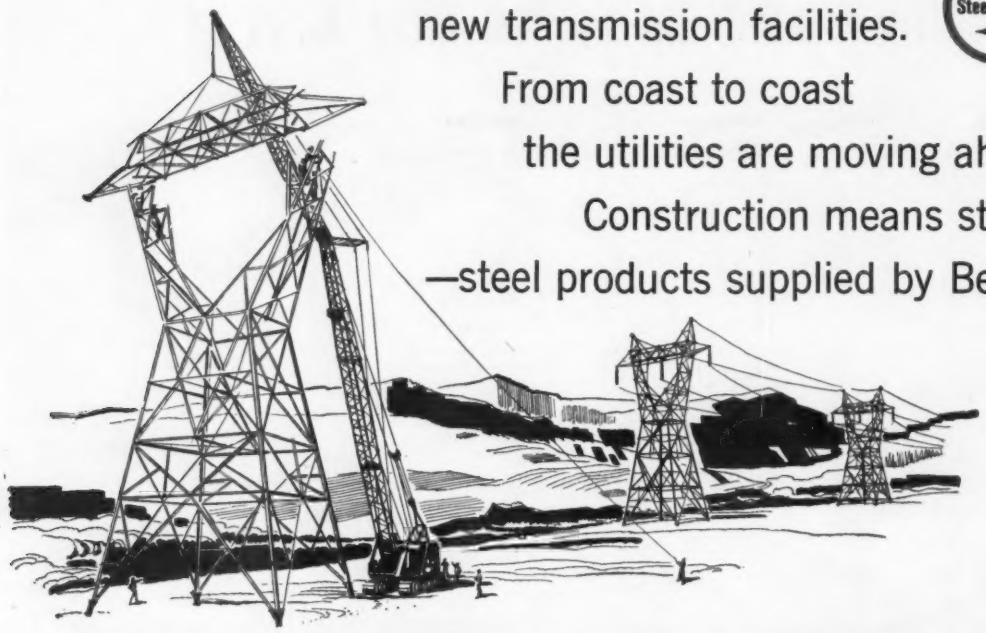
CLARINDA, IOWA • GUELPH, ONTARIO, CANADA • ST. THERESE, QUEBEC, CANADA

Big construction year ahead

New generating plants...
new transmission facilities.
From coast to coast
the utilities are moving ahead fast.
Construction means steel
—steel products supplied by Bethlehem.

Steel

for Strength
... Economy
... Versatility



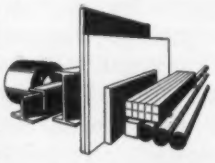
HERE ARE HIGHLIGHTS OF SOME OUTSTANDING CONSTRUCTION PROJECTS:

General Public Utilities—Building an experimental nuclear reactor at Saxton, Pa., for which Bethlehem is designing, fabricating and erecting the containment vessel, 50 ft in diameter and 110 ft high. The reactor will supply steam to operate a turbine at Pennsylvania Electric Co.'s Saxton Station. Penelec is also constructing the nation's first 3-phase 460-kv transmission line, for which Bethlehem is supplying a number of giant galvanized steel towers as well as galvanized strand (½-in., "C"-coated, EHS).

Metropolitan Water District of Southern Calif.—Building an 85-mile, 230-kv line from Boulder City, Nev., to Camino switching station near Goffs, Calif. Bethlehem is supplying 330 towers.

Duke Power Company—Installing an important new substation at Pacolet, S. C., where voltage will be reduced from 230-kv to 100-kv for use by industrial, commercial, and residential consumers in the fast-growing Spartanburg area. Bethlehem is supplying the steelwork.

New England Electric System—Work is well under way on two 225,000-kw generating units at Brayton Point, Somerset, Mass. Bethlehem supplied sheet piling and high-strength bolts for a 1,160-ft waterfront bulkhead, and will furnish fabricated concrete reinforcing bars, fabricated structural steel, and high-strength structural bolts.



Niagara Mohawk Power Corp.—Building a 15-tower line near Schenectady, N. Y. Bethlehem is supplying double-circuit towers and strand for ground wires (½-in. "C"-coated HS).

for the Electric Power Industry

American Electric Power System:

(Appalachian Power Co.): Using Bethlehem towers for a 2½-mile tower section of 138-kv line between the South Lynchburg and Owens-Corning substations in Virginia. Also a 3-mile line connecting the Turner (near Charleston, W. Va.)-to-South Point (Ohio) line with the West Huntington, W. Va., substation.

(Indiana & Michigan Electric Co.): Installing Bethlehem towers on 17-mile steel tower section of line from Twin Branch Plant at Mishawaka, Ind., to the Corey substation.

Northern Indiana Public Service Co.—Now under way with a completely new steam-electric plant (Unit #7) at Baileytown. This 193,000-kw facility will serve new steelmaking operations in the Dunes area. Bethlehem is supplying H-piling, and is fabricating and erecting steelwork.

Consolidated Edison—Increasing capacity of the Astoria generating station in Queens to 1,449,000 kw. Bethlehem is supplying two giant towers for use at the plant, each 157 ft high and having a base width of over 100 ft.

Wisconsin Electric Power Company—Using 189 Bethlehem towers for 31½-mile line from Oak Creek Power Plant to Arcadian substation.

Consumers Power Co.—Building a 265,000-kw steam-electric station at Port Sheldon, on Lake Michigan, for which Bethlehem is fabricating the steelwork and supplying sheet piling. Also building a crossing of the Saginaw River for which Bethlehem is supplying the towers.

Philadelphia Electric Company—Constructing a crossing of the 4,200-ft-wide Delaware River. Two mighty 335-ft main towers, and 150-ft anchor towers are being supplied by Bethlehem.

Southern California Edison Company—Bethlehem furnished forty-eight 220-kv towers for a 9-mile line now under construction from the Mandalay Steam Plant to Santa Clara.

Southwestern Power Administration, U. S. Department of the Interior—Constructing a 161-kv line from Table Rock Dam Project to the Springfield, Mo., substation. Bethlehem is supplying eighteen galvanized steel towers (and reinforcing bars for the concrete footings) for the 2½-mile steel tower section at the Springfield substation end of the line.

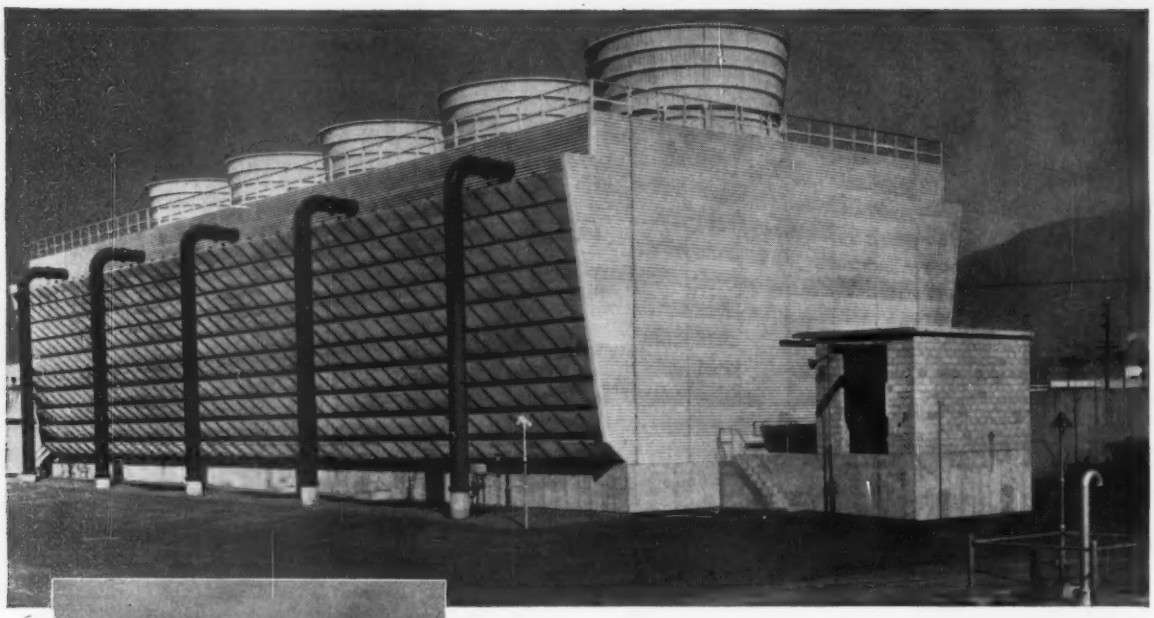
BETHLEHEM STEEL PRODUCTS FOR THE ELECTRIC POWER INDUSTRY

Fabricated and erected steelwork for generating plants, offices, warehouses, stacks, coal-conveying systems, and other structures;
fabricated platework of all types;
galvanized steel transmission towers of all types, and substation steel;
structural steel;
galvanized strand for overhead ground wire and guy wires;
ACSR conductor core wire;
piling: sheet and H-piling;
concrete reinforcing bars, plain and fabricated;
Slabform for poured concrete floors and roofs;
open-web joists, "S" series and "L" series;
welded steel storage tanks;
Bethcoa galvanized steel siding and roofing;
high-strength structural bolts and other fasteners;
steel pipe in all diameters

For further information about how Bethlehem Steel products can help speed your construction projects to completion, just get in touch with the Bethlehem sales office nearest you.

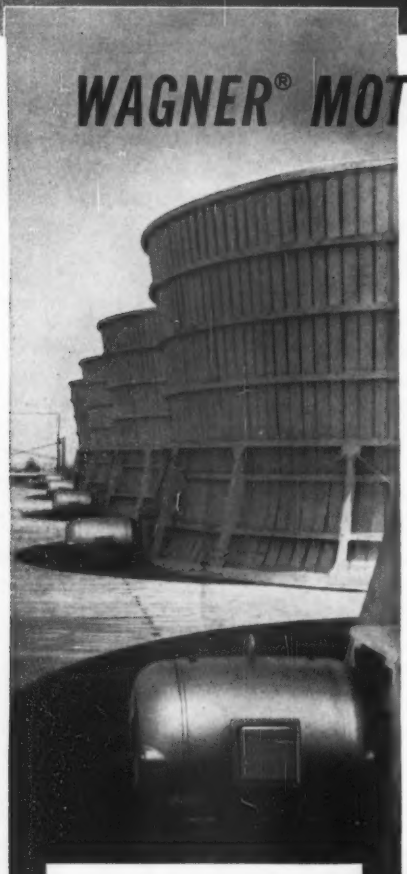
BETHLEHEM STEEL COMPANY, Bethlehem, Pa.

BETHLEHEM STEEL



WAGNER® MOTORS HELP MARLEY TOWER

PRODUCE *MORE POWER* FOR BURBANK



At work on the fan deck: Five Wagner Type EP, 75 hp, 480 volts, 1750 RPM Motors.

This is the new Marley Class 600 Double-Flow 5-cell cooling tower at the power station of the City of Burbank, California ... the newest thing in cooling tower design. Its job: to cool water to get more kilowatts from steam.

Wherever water cooling is vital to plant capacity, product quality or customer comfort, chances are you'll find a Marley Cooling Tower. You'll probably find Wagner® Motors there, too. They're on this tower in Burbank, driving the huge fans used in the tower's cells.

The job is a rugged one. It calls for motors that can operate without attention month after month ... motors that can stand constant exposure to all kinds of weather and to high humidity, the number one cause of motor failure in cooling tower applications.

Wagner Type EP Motors meet these requirements. All vital parts of these workhorse motors are totally enclosed, and are sealed against moisture by a series of grease retaining grooves between shaft and housing. Running shaft seals, at both ends of the frame, prevent the entrance of water into the bearing housings. The frames, endplates and conduit box are made of heavy cast iron for extra protection against high humidity and corrosion.

What about your requirements for motor drives that must operate under adverse conditions? Versatile Wagner Totally-Enclosed Motors can meet them, whatever the application. They are available in standard ratings through 500 hp. Call your nearby Wagner Sales Engineer for full details, or write for Bulletins MU-224 and MU-230.

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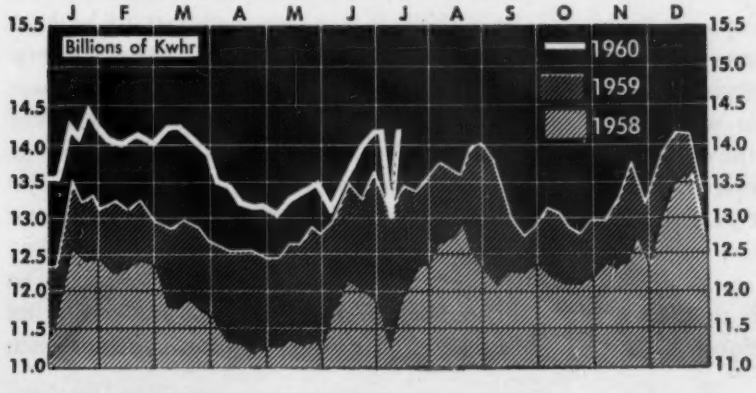
The Electrical Week

LATE NEWS ▸ **The Electrical World** . . . British Channel cable project starts to roll as Central Electricity Generating Board awards $1.7-million cable contract —for half the job—to two British companies. French companies will get the other half . . . Sweden and Norway approve international 380-kv, 400-Mw transmission line. Link joins four Scandinavian countries into 20,000-Mw pool. Sweden will feed Norway summer power, tap Norwegian reservoirs in winter . . . CEGB awards Dungness Nuclear station contract to The Nuclear Power Group, combine of two largest British companies. Rated 550 Mw, Dungness will have twin gas-cooled, graphite moderators.

Product News . . . RT&E Corp will stand fast on 55-C rise and single rating for distribution transformers. Company claims built-in 15% overload capacity is equal to capabilities of 55-C/65C ratings previously announced by four other companies.

Around the States . . . Next round in struggle between Arizona Power Authority and Los Angeles over Bridge Canyon Dam will tee off Sept. 12, in FPC pre-hearing conference. Principals will testify Oct. 24, other parties, Nov. 28. US Supreme Court will consider special master's plan for splitting Colorado River water between two groups . . . Utah P&L eyes acquisition of Uintah P&L through swap of shares. Uintah has 2,600-kw capacity, serves 1,398 customers in two Utah towns . . . Paducah, Ky., will vote on proposed municipal system Nov. 8. Affirmative vote will replace Kentucky Utilities with TVA power. In nearby Princeton, Ky., KU asks county to delay appointing appraisers in city's condemnation suit . . . Puget Sound P&L offers package deal to six schools in fight to limit Tacoma City Light encroachment . . . Fall River Electric Co-op (Ida.) offers half-million for properties of Teton Power & Milling Co, a small private company.

WEEKLY POWER OUTPUT—UP 5.9% (Week ending July 16), Kwhr 14,208,000,000



Per Cent Change From Previous Year

	July 2	July 9	July 16
Total U. S.....	+ 8.6	— 3.5	+ 5.9
New Eng.	+15.1	— 4.3	+ 4.2
Mid. Atlan.....	+10.8	— 6.2	+ 7.0
Cent. Ind.....	+ 3.7	—10.5	+ 1.3
West Cent.....	+10.5	— 4.8	+10.3
Southeast	+ 8.4	— 1.7	+ 6.0
South Cent.	+ 8.2	+ 4.9	+12.7
Rocky Mount...	+14.9	+ 2.7	+ 6.2
Pacific			
NW	+ 9.4	+ 2.0	+ 6.8
SW	+11.3	+ 1.6	+ 5.7

Seasonally Adjusted Index 271.2
Week Ago 264.8 Year Ago 258.5

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Sen John F. Kennedy favors federal power projects,** continued assistance to cooperatives. Report on voting record and statements **(p 40)** . . . Power groups appear before Republican platform writers **(p 41)** . . . US and Canada resume talks on river development **(p 41)** . . . Labor difficulties break out in utilities **(p 42)** . . . Hudson River transmission crossing to Indian Point is long, high, and high voltage **(p 43)** . . . Fleet managers answer: Who's holding back aerial lifts? **(p 44).**

CIGRE ▶ **Paris conference studies power system needs,** sees no sign of letup in movement of transmission and cable voltages into EHV ranges. Estimated 1,800 power system engineers attending the 18th biennial session view continuing trend to boost generating capacities and to interconnect and exchange power with other systems and regions. Roving Dan Braymer's report on the conference begins on **page 45.**

ENGINEERING ▶ **Service reliability data is obtained quickly** by use of punch card recordings. West Penn Power has employees investigating complaints, mark cards while in the field, providing data for detailed outage analysis **(p 49)** . . . Seeking competitive nuclear power for the Southwest, 15 investor-owned utilities have instituted a two-part study of a 360-Mw reactor. Two articles on this $5.3-million search appear on **page 52.**

Politics and Public Power

THEY CAN'T LOSE THE ELECTION

Of all the special interests watching the Presidential campaign, few enjoy the enviably secure position of the rural electric cooperatives. Regardless of which party wins the election, the co-ops will be protected because politicians appear to consider the co-ops blocs pivotal in king-making agricultural states.

If the Democrats win, the co-ops can look forward to a sympathetic understanding from the party that helped found them. If the Republicans retain control, the worst that will happen is a continuation of the extremely soft pressure toward putting co-ops on a businesslike tax and interest rate level, which they may be ready for.

There is increasing evidence that co-ops are approaching maturity as businesses. Most recent and solid evidence is the issue of 2% US Treasury bonds for the co-ops to buy with surplus funds. Reserves available for this investment stand at about $441.5 million right now, and are building fairly rapidly.

A strong hint of the cooperative financial position is found in speeches of Sen John F. Kennedy as he stumped through farm states during the recent primaries. Time after time he said: "It is true that most farms now have electric lights. It is a fact that REA cooperatives and power districts are well established, well accepted enterprises. There is no doubt that the dream first visualized by George Norris (who incidentally ran under the Republican banner) and Franklin Roosevelt has been fulfilled."

There is more evidence: The trend to co-op loadbuilding over the past six years instead of just line extensions; the presence

PROCUREMENT & PRODUCTS ▶ **Price upturns are in the offing** in two distribution product areas. One barometer to watch is the recent high price tag of 50-kvar capacitors . . . Big three manufacturers are considering a more comprehensive role in capital facilities addition (p 62) . . . Delta-Star Electric recently tested a "cool" vertical-break air switch. Examined under ice conditions, 345-kv, 1,600-amp switch broke ice layer and opened successfully . . . Transformer operates quietly with core and coils isolated from three-piece case . . . Bushing for 15 kv and below is usable with lead, rubber, and other unshielded cables (p 68).

MANAGEMENT ▶ **What's wrong with public utility regulation?** Plenty, the New York Chamber of Commerce found in 1958 when it began a report on regulation of utility enterprise. Just published, it forms a worthwhile addition to Bell System "Profits and Progress" studies.

SELLING ▶ **Experiments on a solar heat collector** working in conjunction with heat pumps show: Heat pump performance coefficient is raised; heat pump output is greater; number of heat pump defrosts is reduced; and danger of overheating motor windings is decreased.

NEXT WEEK ▶ **Be sure to read about Sweden's new type of 380-kv line tower.**

of new G&T co-ops, and even the loud protestations of impassioned leaders of the cooperative movement that all this evidence isn't true help to firm up the belief that co-ops are ready or nearly ready to stand on their own without federal aid. But they do not face a very strong possibility that this will be expected of them.

Republicans are pledged to honor the needs of preference customers, including cooperatives, as are Democrats. The preference position is important federal aid, because both parties will push development of multipurpose projects and the cooperatives in the regions around them will benefit directly, regardless of who builds the projects. The question of the cost of the power is hardly valid, either, because of the tight federal control of projects, transmission facilities and charges, even when a project is developed by an investor-owned utility. Where co-ops obtain their power from electric companies, we are under the impression that the co-ops obtain reliable service at favored-customer rates. Certainly the rates will never exceed what the co-op customers can reasonably afford to pay.

So why the hue and cry?

The co-op spokesmen have had practical political experience. They know that if you want to throw your weight around in Washington, you must have laid the groundwork during the political campaigns. And it is just possible that part of the noise can be attributed to empire builders who dare not let down on their emotional cries of alarm. If they should remain quiet, it might be that politicos would find rural electric co-ops have reached financial maturity and no longer need federal aid. They might also find that co-ops and utilities are not mortal enemies.

Nuclear Notes

Nuclear plants will generate 16% of 11 x 10^{18} Btu of electric energy required in the US to the year 2050, says a report by Drs Chauncey Starr and R. A. Laubenstein of Atomics International. Uranium supplies are sufficient to furnish this energy with a nuclear fuel-cost increase of about 25%, while the cost of fossil fuels will go up 50%. The authors considered only converter reactors and not breeder reactors, although "60 times as much energy may be obtained per unit weight of uranium by the breeder reactor fuel cycle as by the converter reactor fuel cycle."

Step toward solution of the nuclear-waste disposal problem has been taken by General Electric's San Jose, Calif., atomic lab. A new incinerator for burning wastes from the company's fuel manufacturing incorporates a filter that removes radioactive particles from the flue gases. Waste disposal costs have been reduced by 75%, and the ash which must be buried is only a tenth the volume of the material burned.

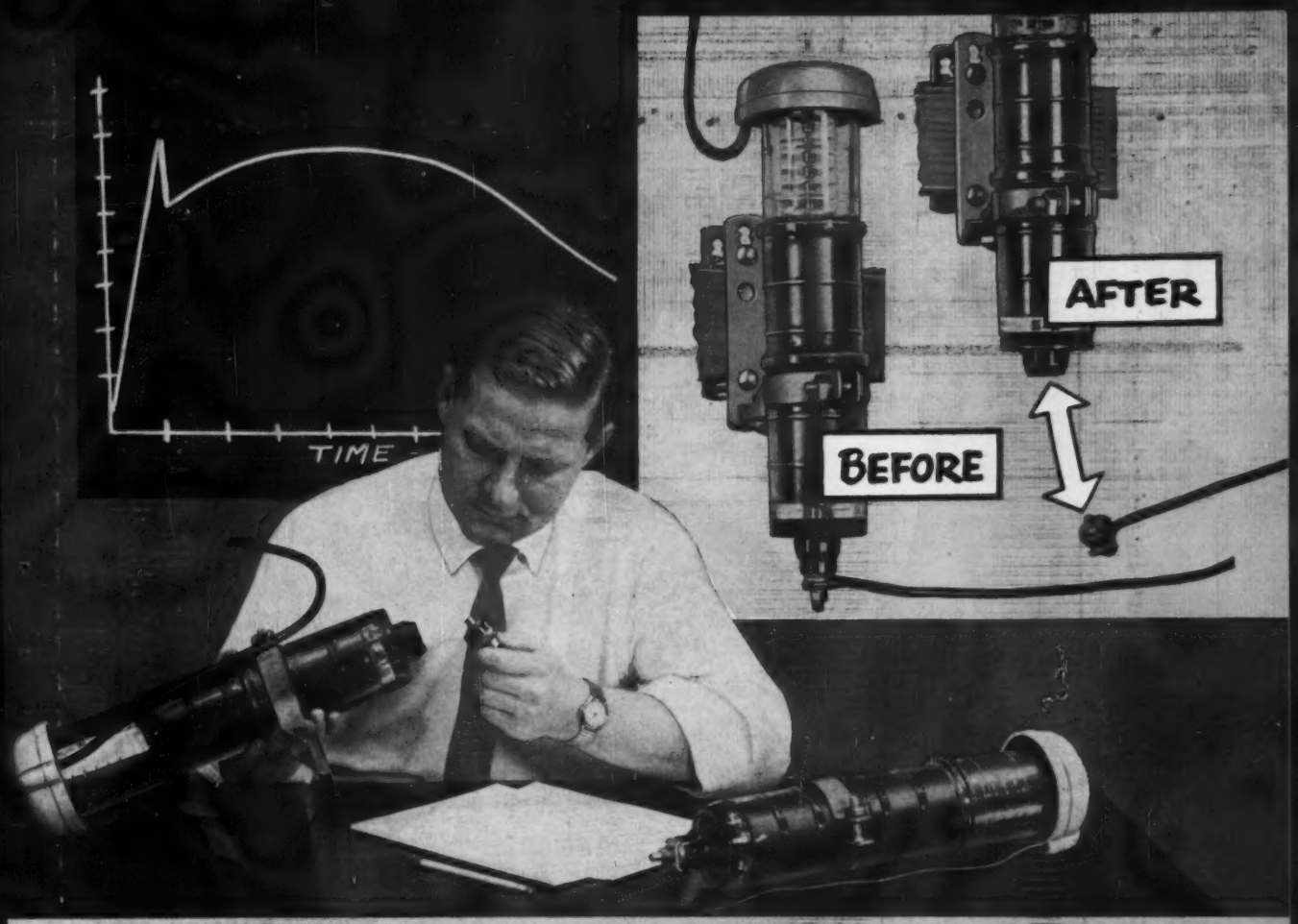
Revised proposal for Jamestown, N. Y., reactor plant site has been given to the Advisory Committee on Reactor Safeguards for consideration. The municipality proposed a larger plot of ground at the same spot after the AEC said its first plan was not adequate. The enlarged plot still does not meet the AEC requirement that the reactor operator own all the land within 2,000 ft of the reactor, but approval is nevertheless not counted out.

Nuclear fuel processing plant owned by 12 European nations and Turkey was dedicated this month at Mol, Belgium. The plant is being built by Eurochemic, joint undertaking set up by OEEC, the organization originally formed to coordinate the Marshall Plan.

Safety record among its employees at Hanford is excellent, GE reports. In 15 years no one has received as much as one-third the permissible dose of radiation. Of 7,803 employees at the end of 1959, more than 90% of the workers had received less than 10% of the maximum allowed accumulated dose.

Consumers Power broke ground July 20 at Big Rock Point, Mich., for its 50-Mw high-density boiling-water nuclear plant, which will cost about $27 million.

Euratom will open its European University in Florence, Italy, with 250 students in the fall of 1961. Later classes will be 500 strong. Although set up under the atomic power authority of the European Community, the school will offer a broad university curriculum, including sciences.



Above: at left the L-M Type E-3 9kv arrester. At right, the same arrester after the Isolator has been made to operate by deliberately failing the arrester with a high overvoltage. The Isolator disconnects the ground instantly so that the back-up device does not lock out and permanently disconnect a whole section. And the disconnected ground lead is easily seen. Lightning Arrester Engineer F. Schultz examines the Isolator.

The "Isolator" On L-M Arresters Positively Prevents Line Lockout

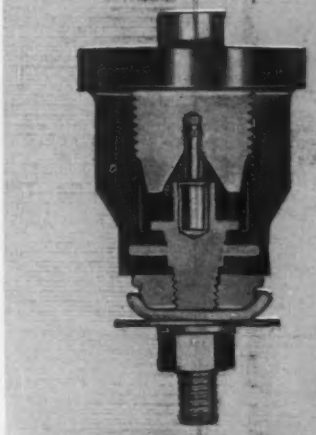
One utility company that has kept accurate records reports that in 167,410 L-M arrester-service years, over 12 years, there were only 59 Isolator operations in service. This is a truly remarkable record. Probably only L-M Valve arresters could have established such a low failure rate—three-hundredths of one percent!

Those 59 Isolator operations indicated arrester failure from whatever cause—direct strokes, overvoltage, or other causes. Without the Isolator, the feeder could have been grounded, and the back-up protective device locked out. Crews would have been out, trying to find the faulty arrester—not an easy task—and a costly one.

The L-M-Isolator instantly cut off the ground; and the disconnected ground lead could be easily seen by a line crew.

The Isolator was originated by L-M. It has been in service more than 20 years. The Isolator has definite time-current characteristics, so that a definite amount of heat from follow current is required to operate the Isolator. It operates any time that the arrester fails, or is about to fail.

The Isolator is only one of many superior features of L-M Valve Type arresters. Ask the L-M Field Engineer for details, and a copy of L-M's paper, "Lightning Arrester Application". Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.



Cutaway view of L-M's insurance device, the Isolator. Should a shorted gap or clinkered element permit follow current to continue to flow, the heat operates the Isolator instantly, before the back-up device can lock out. The time is controlled by the time-current characteristics of the Isolator. This prevents a faulty arrester from grounding feeders, cuts hunting time and service outages.

LM®

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

458

Lightning Arresters

McGRAW EDISON

DISTRIBUTION TRANSFORMERS • RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

COMING YOUR WAY ...a new

THIS IS THE ONE, developed to meet your needs... the Sangamo J3 Singlephase Watthour Meter. No warmed over, weary, compromise copy this. No follow the leader, last-with-the-least version of any other meter in the world. This is the J3... the only meter with true magnetic flotation. The one new, noteworthy development in watthour meters this year. One of the exceptional advances in metering in any year!

The Sangamo J3 has these new features:

TRUE MAGNETIC FLOTATION... the moving system of the J3 is not suspended, supported, harnessed or trapped. It floats, pure and simple, permanently and without friction, on a field created by Alnico magnets that are dimensionally and magnetically uniform.

VISIBLE, SELF-CLEANING GAP... because the magnets repel each other, the gap stays clean; it cannot be bridged by metal particles.

CONTROLLED FLOATING SYSTEM ... in the J3, endshake is controllable to assure best performance on high loads. The dual damping magnets in the J3 substantially reduce side thrust, and tilt-error is insignificant. These features, combined with the unique slow speed of Sangamo J Meters, give you a moving system that is *guaranteed for life.*

ADVANCED INSULATION LEVEL... Epoxy-coated current coils, proven on Sangamo polyphase meters, provide better insulation, facilitate heat dissipation.

SMALLEST SIZE... the J3 is smaller than other meters, making it easier to handle.

NEW DESIGN... provides better visibility for inspection and testing.

Plus these traditional Sangamo advantages:

HIGHEST TORQUE... up to 15% more than that of any other meter.

SLOWEST SPEED... 40% fewer revolutions than any other meter.

LOWEST STARTING WATTS... starts to operate before any other meter; requires 25% fewer starting watts to begin measuring; total watts loss is lower.

SECTIONALIZED CONSTRUCTION ... any component can be inspected and replaced without completely disassembling the meter. Many parts are interchangeable with J and J2 meters.

CORROSION RESISTANT FINISHES & MATERIALS... end maintenance problems caused by weather and atmospheric conditions.

GLASKYD BASE ... with tremendous impact strength that shrugs off rough treatment. Has better arc tracking resistance, too.

Your Sangamo Representative is coming your way with a sample of the new J3. Probe, pry, pore over it. Write it into your standards. Then, put it to work... for this has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.

watthour meter...the Sangamo

true MAGNETIC flotation J3

SANGAMO ELECTRIC COMPANY/ SPRINGFIELD, ILLINOIS

JM60-5

Do these fit you?

The new O-B stacking Unipost is interchangeable in its stacking position - - the identical unit goes in the top, intermediate, or bottom position. No more single-purpose stacking units. No more confusion in the warehouse or on the construction site. No more needless, triple inventory.

This applies to *all* Unipost combinations. But, some offer a still further advantage. Certain Unipost units act as components for two or three different BIL ratings, depending only on the number of identical units used. If this is the case, just one Unipost catalog number in your stock will build or maintain two or perhaps three different BIL-rated stacks. The chart here tells the story. Study it carefully. It may offer a lot of saving - - in money as well as trouble.

O-B has modernized the stacking insulator with its new Unipost - - simplified its application - - reduced its inventory cost - - improved basic post design.

When you specify new switchgear, or when you plan new stations, be sure to include the new O-B stacking Unipost.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

If your station insulation fits any of these popular patterns, your cost of stacking post insulator inventory can go 'way down!

Unipost unit catalog numbers, and the complete stacks each unit will build. The same unit fits all stacking positions. There are additional Unipost units and stack combinations. For the complete series, see new O-B Switch and Bus Insulator Catalog No. 32, or O-B Publication No. 1459-H.

10010-H

STANDARD STRENGTH

HIGH STRENGTH

EXTRA HIGH STRENGTH

Normal Range of Application
Operating Voltage kv

650 kv BIL
900 kv BIL

Unit No. 47975

138 • 161
195 • 230 • 287

750 kv BIL
1050 kv BIL

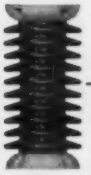
Unit No. 47977

161 • 195
290 • 287

825 kv BIL
1175 kv BIL

Unit No. 47984

195 • 230
330



650 kv BIL
900 kv BIL
1300 kv BIL

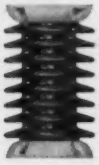
Unit No. 47985

138 • 161
195 • 230 • 287
287 • 330

750 kv BIL
1050 kv BIL
1470 kv BIL

Unit No. 47987

161 • 195
230 • 287
460



825 kv BIL
1175 kv BIL

Unit No. 47994

195 • 230
330

650 kv BIL
900 kv BIL
1300 kv BIL

Unit No. 47995

138 • 161
195 • 230 • 287
287 • 330

750 kv BIL
1050 kv BIL
1470 kv BIL

Unit No. 47997

161 • 195
230 • 287
460

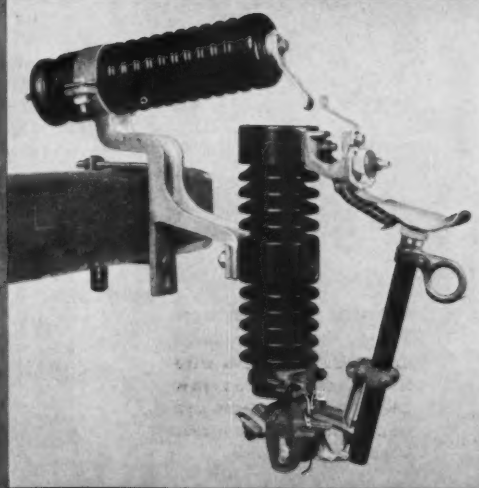
NEW arrester cutout combination

for pole or crossarm mounting

Now you can get a directly-connected or externally-gapped Magne-valve arrester and open cutout combination that is easier and less costly to install. This new General Electric cutout-arrester combination is available in several standard ratings, for 7200 volt to 15000 volt circuits. It makes a more compact installation on the pole since it takes up less space than the conventional mounting of individual units.

It costs less than separate units, too. You also save in hardware, installation and inventory costs. The unit is packaged and pre-assembled—only two carriage bolts have to be tightened. Brackets for direct-to-pole mounting are also available.

Take advantage of the proved-in-service operating reliability of G-E lightning arresters and cutouts. Ask your General Electric Sales Engineer about the new arrester-cutout combination, or mail the coupon below.



SIMPLIFIED CROSSARM MOUNTING

GENERAL ELECTRIC CO., SECTION D488-05
SCHENECTADY 5, NEW YORK

Please send me the publications I have checked below:

- ☐ Bulletin GEA-4224, "Flip-open Fuse Cutouts"
- ☐ Bulletin GEA-6825, "Oil Cutouts for Fusing and Switching"
- ☐ Bulletin GEA-1816, "Open-dropout Fuse Cutouts with Gas Load Break"
- ☐ Bulletins GEA-6208 and 6245, "Enclosed Cutouts"
- ☐ Bulletin GEA-6379 "Magne-valve Distribution Arrester"
- ☐ Please have G-E Sales Engineer call

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Don't Price Yourself Out of the PLUS Features You Get with SQUARE D CONTROL CENTERS

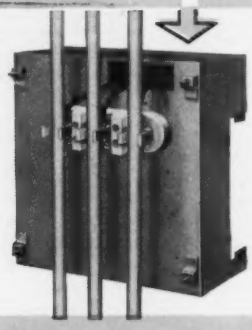
Industrial construction
All outer surfaces and structural parts are 12 gauge steel. Corner channels, cross members and doors are *formed* on special dies for maximum rigidity. Rust-resisting finish—phosphatized plus *baked* enamel.

Saves space
Unit heights in *3-inch* increments—an exclusive Square D advantage which permits use of units with minimum heights, eliminates the wasted space typical of modular systems.

Built-in safety
Units are metal-enclosed to confine damage should a fault occur. Unit side plates are permanently attached—can't be accidentally discarded. Switch-type units have visible blade disconnects for added safety.

Extra control flexibility
A variety of removable panels accommodates up to four oil-tight push buttons and pilot lights.

Tubular vertical buses
Another Square D "exclusive"—inherently stronger—greater cooling surface. Extra-wide spacing between phases gives added "breakdown" protection. Plug-in stabs are silver-plated copper backed by steel springs—give high pressure low resistance contact at all times.



Liberal wiring space
Wiring channels are *large and accessible*. No wire fishing through narrow passageways—wires can be laid in position—less costly installation.

GET THE COMPLETE STORY

BULLETIN SM-244 gives detailed information on all of the "plus" advantages you get when you specify Square D motor control centers. Send for a copy. Square D Company, 4041 North Richards St., Milwaukee 12, Wis.

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wherever electricity is distributed and controlled

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Caliband is an Allis-Chalmers trademark.

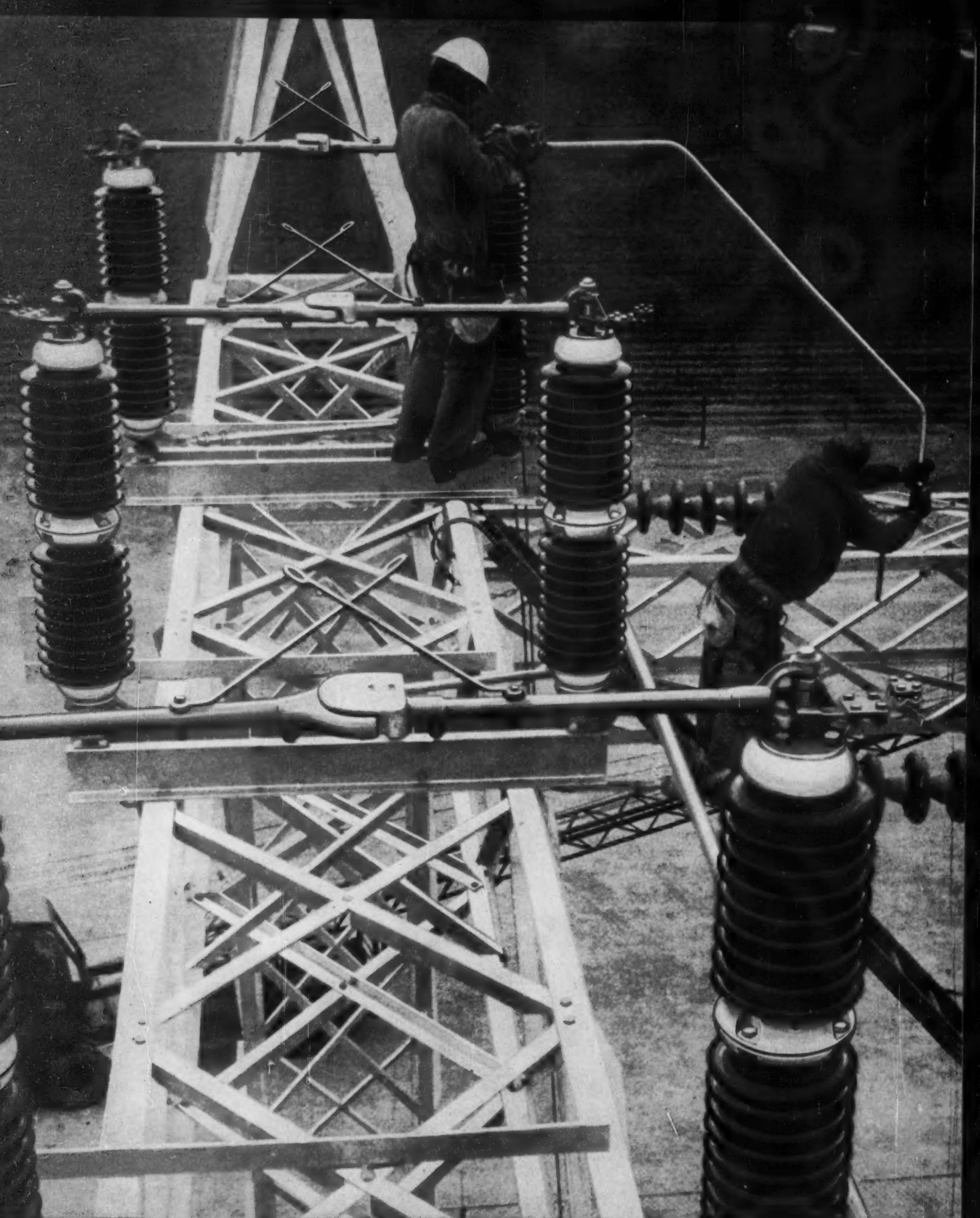
Lower! Lighter! Perfect for joint-pole use

new JFR regulators cut installation costs

CALIBAND control slashes setting time without changing customer voltage or interrupting service! A twist of the knob and you set or test voltage level and band width. No need to return compensator settings to zero.

Allis-Chalmers all-new JFR is the top qualifier for joint-pole use . . . pad or platform mounting. Tank size and weight reduced up to 33%, due to JFR's improved materials and design techniques. Naturally, you save on transportation, handling and installation.

More new JFR advantages! Now offered as *standard*, position indicator drag hands reset by pushbutton on the control panel. A new, quick-sight gauge instantly reveals oil level. Exclusive unidirectional breather removes all moisture and contaminating gases. And a new cover, with hidden bushing mounting studs, cuts maintenance. *For all the facts ask your nearby A-C office for new JFR Bulletin 21B7977E or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1261



Southern States 115 kv, 600 ampere Type GG switches being installed. The GG is available in voltage ratings from 34.5 kv – 161 kv and continuous current ratings of 600 and 1200 amperes.

KEEP PACE WITH ELECTRICITY

CURRENT FOLLOWS LOW RESISTANCE PATH THROUGH SOUTHERN STATES' BRAIDLESS AIR SWITCHES

Southern States has solved the big problem of providing efficient current transfer in high pressure, braidless side-break air switches. A unique design overcomes any question of reliability in the two current-carrying swivel assemblies inherent in this type of switch.

As a result, in the new Southern States Type 57L and Type GG you can now be assured of low resistance through each swivel assembly, adequate capacity for short circuit currents, and freedom from corrosion and contamination.

This is accomplished by the four-piece swivel units* consisting of carefully machined terminal and blade castings, hinge pin, and pressure clamp —securely bolted together so that the pressure clamp and terminal casting fit into deep, matching grooves on the hinge pin. The silver-plated grooves provide a natural barrier to foreign matter, act as a stable bearing surface for the terminal, and furnish a liberal contact area. The assembly is permanently sealed with a non-aging lubricant.

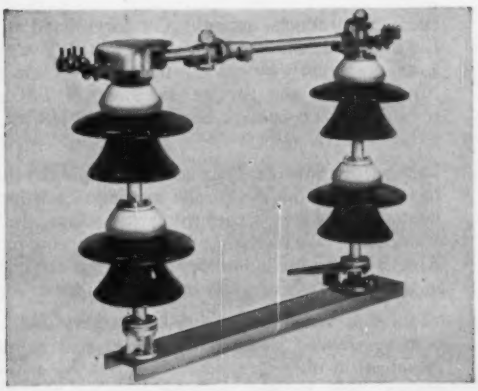
The hinge pin and terminal casting are kept under high pressure by a stainless steel coil spring (insulated by a nylon spacer) to establish the most efficient current interchange point.

The entire assembly, although under high pressure, rotates smoothly—without binding or wedging. It operates satisfactorily under short circuit conditions and well within the limits defined by NEMA for continuous current performance.

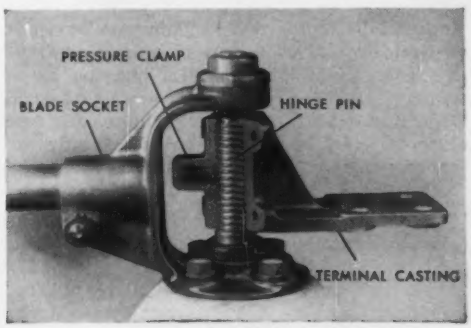
AMPLITACT® contacts are added assurance of contact performance under extremely high fault currents.

For complete details on these new braidless switches, contact your Southern States representative or write directly to us.

*Toggle point of 57L switch blade uses modified version of this assembly.



Type 57L braidless side break available in voltage ratings from 7.2 kv - 161 kv and continuous ratings of 600 and 1200 amperes.



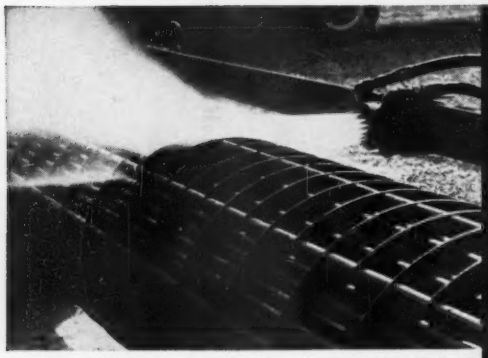
SWIVEL ASSEMBLY—CUTAWAY VIEW

The GG uses the swivel assembly shown as the pivot on both rotating insulators. The 57L uses an identical assembly on its rotating insulator and the same construction principle at the toggle point of the 57L blade.

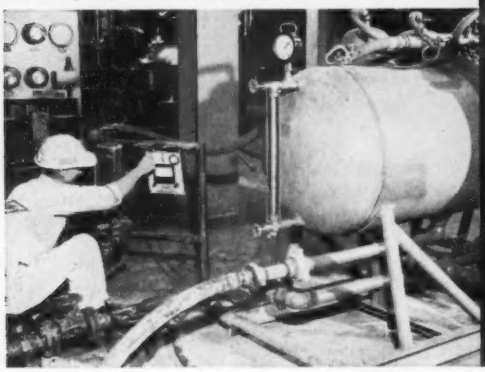
SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

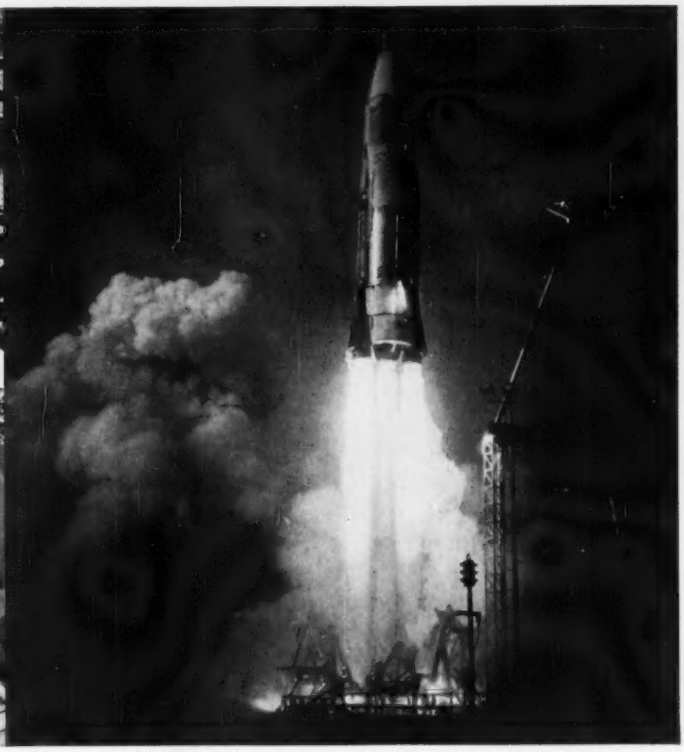
A new mark for a nation-wide cleaning service . . . DOW



Jetting tool cleans tubes fouled with coke and asphalt.



New mobile foam-cleaning equipment cuts cleaning costs.



Cleaning missile lines and components requires tolerances as close as 150 microns.

DOW INDUSTRIAL SERVICE

Industrial Cleaning. Dow Industrial Service, now a separate division of The Dow Chemical Company, offers the only nation-wide chemical cleaning service for virtually all types of industrial processing equipment. This is an expansion of the cleaning service developed over the past 20 years. Dow is currently servicing entire plants as well as doing special cleaning jobs for both large and small companies.

Dow Industrial Service research in industrial chemical cleaning has developed specialized mobile equipment and techniques, some of which are pictured above. These highly efficient techniques are improving plant productivity and reducing equipment downtime in all industries using steam generators, condensers, heat exchangers, towers, water and product lines, water wells and tanks, or similar process equipment.

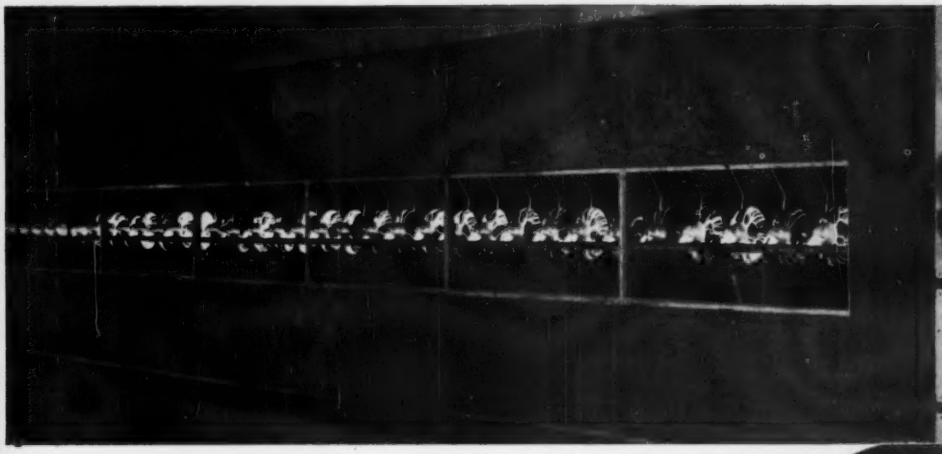
Product Sales and Service. The sale of specialized chemical products, scientifically formulated to be of use in specific industrial processes and to give the necessary technical service in their use, is the job of Product Sales and Service. Purifloc* N17 is an outstanding new flocculant cleared by USPHS for use in potable water.

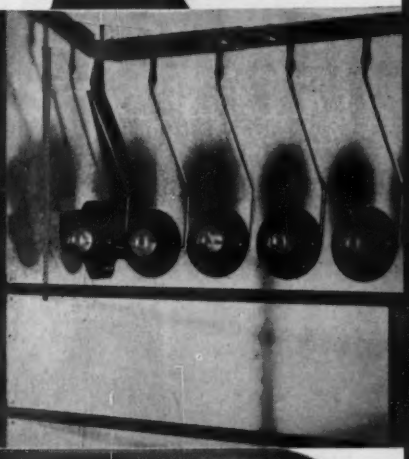
Laboratory Service. Because of the rapid development of chemical products for the municipal and industrial waste and water treatment areas, Dow Industrial Service will take on the service-selling of those products. Also, a consulting laboratory service for municipal and industrial waste and water treatment is provided.

You'll find Dow Industrial Service offices and stations with specialized cleaning equipment and experienced personnel in all major industrial areas. For more information, write to Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio. *TRADEMARK

DOW INDUSTRIAL SERVICE DOW *Division of THE DOW CHEMICAL COMPANY*

We make 'em good





...and we make 'em prove it!

You never see a Lapp suspension insulator until it's been proved equal—or superior—to your specifications.

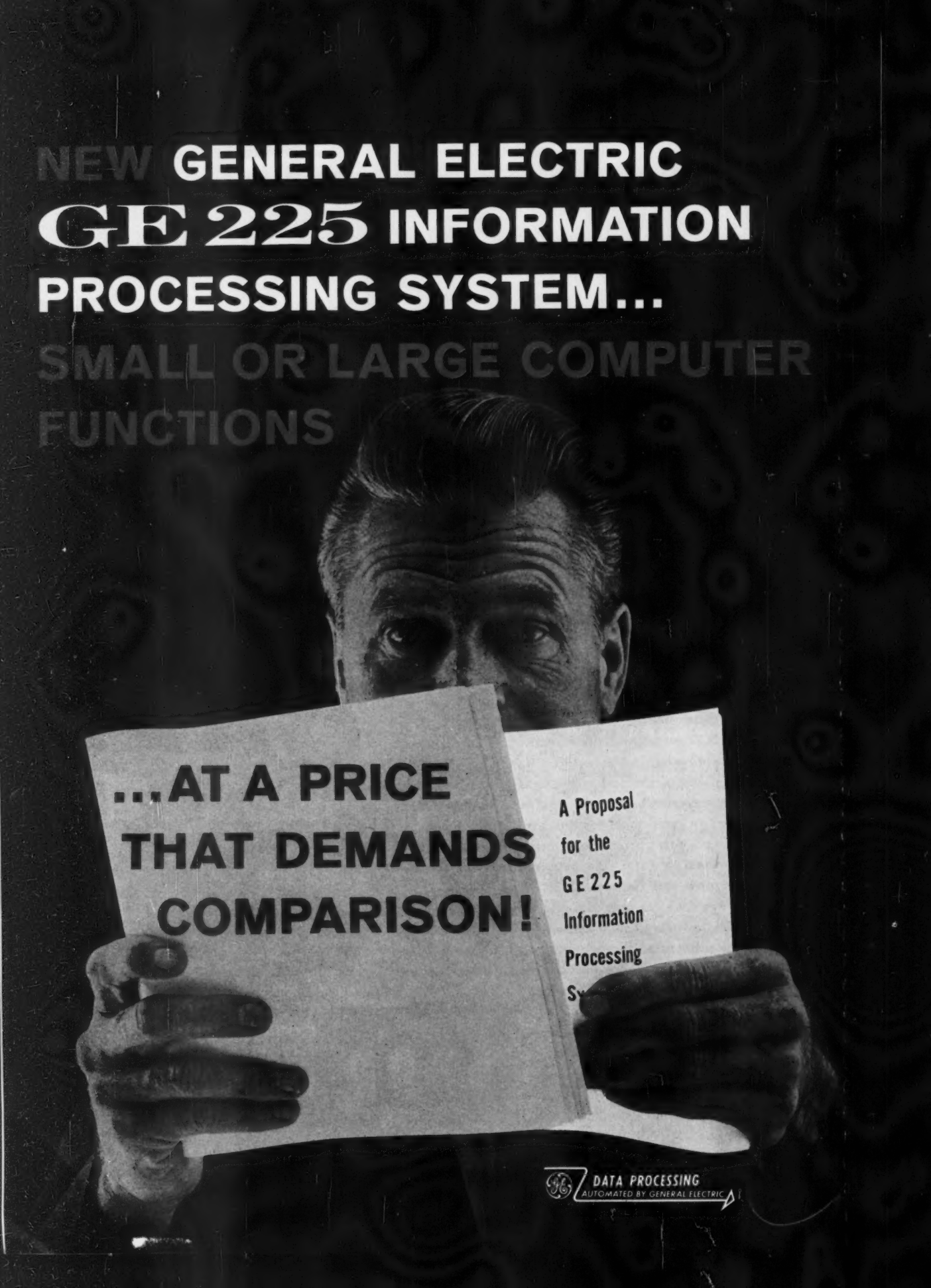
This high frequency flashover test is one of the many ways we prove our insulators. We put every unit through electrical and mechanical punishment far beyond what it should experience in service. And we keep production uniform, for predictable performance on your lines.

Testing is part of the continuous program of product improvement at Lapp. We keep making 'em better—and we prove each improvement.

But our tests are only physical proof. You may be more impressed by the dollars-and-cents proof in your own operating record. See what your Lapp insulators have saved you in maintenance and replacement costs. Add up the months of uninterrupted service on your Lapp-insulated lines. And remember it next time you order.

Lapp

Lapp Insulator Co., Inc.,
Le Roy, N. Y.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SMALL OR LARGE COMPUTER
FUNCTIONS
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THAT DEMANDS
COMPARISON!
A Proposal
for the
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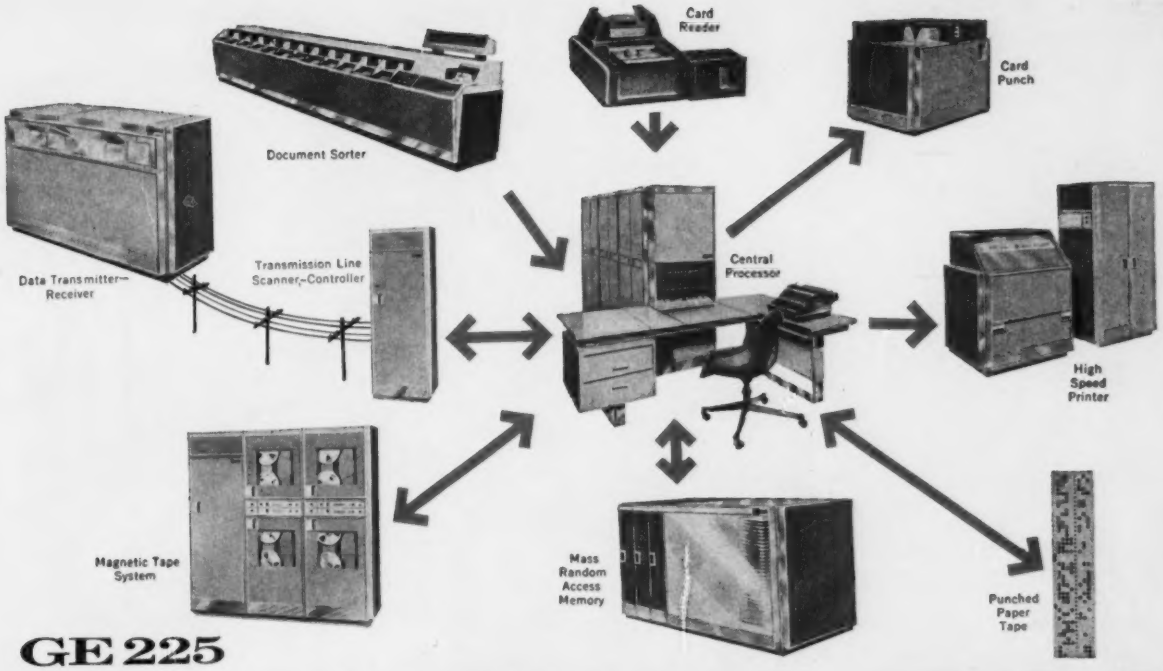

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provides these benefits for business, industrial, scientific, military and engineering applications:

•Data mating function enables GE225 to be teamed with every major peripheral device—new MICR* documents, punched cards, punched paper tape, magnetic tape, mass random access memory, drum memories, high speed printer, typewriter, high speed transmission lines. The new GE 225 Information Processing System:

performs a multitude of jobs at much lower cost.

provides greatest efficiency—operation of central processor with all major peripheral units simultaneously, on a priority basis, gives maximum utilization of machine time.

allows low cost additions and substitutions of existing and future inputs-outputs to meet changing or expanding needs.

permits many varying and money-saving applications within one organization.

•High speed operation from buffered circuitry permits 25,000 five-digit additions per second.

•Adapts readily to existing card and tape systems at minimum conversion cost.

•Compactness and low power requirements reduce cost of installation, site, air-conditioning, operation and maintenance.

•Optional built-in floating point saves operator and programming time.

•Versatility makes system practical for use and planned growth in smaller firms where computer operation has heretofore been unfeasible.

•Full range of services—programming aids package, General Compiler, General Assembly Program, training and consultation, back-up computer centers, and maintenance program—assures peak efficiency.

For more detailed information, write today for brochure CPB-101 on the new GE 225 Information Processing System. Also available: brochure CPB-81 on the GE 210 Data Processing System.

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JULY 25, 1960

Let's Turn Our Technical Face to the World

The US electrical utility industry long has abstained from wholehearted participation in international engineering affairs. This tradition is still with us, as was apparent at last month's World Power Conference in Madrid and CIGRE meeting in Paris.

Yet, now, more than ever, it is vital that the US turn its best technical face to the world. Our utility industry certainly can play an important part, if it only will make the effort.

World Power Conference and CIGRE gathered the cream of the globe's power system engineers from 50 nations. Over a three-week period, at the two meetings, these eminent authorities weighed the effect of new fuel sources on present generation patterns, considered the need for higher transmission voltages, and studied the effects of growing interconnection on such things as switchgear and system stability.

At both conferences, US engineers were indeed present, and US practice was recorded in formal paper programs designed by US national committees under distinguished leadership.

Unfortunately, however, US utility industry attendance and participation *in floor discussions* at both meetings reflected scant credit on a technically-advanced nation of 180 million with a generating capacity of 160,000 Mw.

US delegations, including utilitymen, manufacturers, consultants, educators, and national committee officials, numbered 66 at Madrid and 54 at Paris. But only 29 and 19, respectively, represented utilities. Generally, they came from a tiny cadre of organizations that have understood the merit and the obligation we have to uphold the prestige of US power system engineering among the nations of the world.

Aside from the international prestige requirement, American power systems today stand to profit greatly from European experience with 400- and 500-kv transmission, series capacitors, EHV cable research, dc transmission, and system stability studies. Reports in this issue give eloquent testimony to this fact (p 45).

European power systems, on the other hand, can benefit from US experience with high pressure-high temperature steam cycles, automation, tie line load control, economic dispatch and computer technology.

But in order for the necessary exchange to take place in an orderly and efficient manner a number of conditions must be met:

1. Utility management must encourage and finance company and individual membership in organizations like the International Conference on Large Electric Systems (CIGRE) as a matter of policy.

2. Utility representation on US delegations to international engineering gatherings, like World Power Conference and CIGRE, must become a matter of industry concern.

3. Finally, our utility delegations must be encouraged to be more outspoken on matters where US experience has something to contribute, or a position to support.

If any criticism could be leveled at the loyal group of utility people who have been our sole spokesmen at international gatherings it is that they haven't been vocal enough. At Paris and Madrid, our authors defended their papers stoutly enough, but in discussion of broad issues from the floor the US was outnumbered 10 to 1 by more vocal delegations. Certainly we are not as uninformed and inexperienced as we may have appeared on engineering issues.

Kennedy Senate Record Shows Government Projects Favored

Sen John F. Kennedy, the New England urbanite who has courted the western states ardently in his bid for the US Presidency, has built a solid record of support for federal development of water resources and power.

A look at his public statements and his voting record in the Senate leaves no doubt where he stands on power issues. A tabulation of his votes by public power advocates shows that he voted their way on just about every major issue.

In his swings through the Midwest and Rocky Mountain states during the primaries, the Democratic nominee evoked the memory of George Norris (a Republican) and condemned the Eisenhower Administration for its "too timid, too little, too slow power policy."

Supports Expanded REA Program

Speaking to a Young Democrats luncheon in Bismarck, N. D., Sen Kennedy said:

"Rural electrification cannot stand still in an age when it must either move ahead—or wither on the vine. But if it is to move ahead, REA rates must remain low—more generating capacity must be developed—the vast resources of nuclear energy must be tapped—your high-grade lignite mines must be utilized—and the guiding spirit of George Norris must prevail."

The Eisenhower Administration he charged, has attempted "to rewrite the past . . . to deny co-ops the right to operate in areas which could potentially be served by a private power company — absolutely regardless, mind you, of how high those private power rates are, how poor its service may be, or even how unlikely its intentions really are of serving those customers." He roundly condemned "an REA administrator who openly advocates higher interest rates upon REA loans" and a Federal Power Commission "that does not believe in public power and does not understand the preference clause." He backed up his attack on the FPC with a vote against confirming Jerome K. Kuykendall for a second term on the grounds that he had been a captive of the private power and gas industries.

Kennedy went still further for the REA's. Financial stability for rural electric systems, he warned, is no signal to increase rates and costs to the system. It is a signal instead to reduce the cost of electricity.

Here are some of Kennedy's key votes in the Senate directly affecting the power industries:

- For an amendment to the Priest Rapids Dam Bill requiring preference for public bodies and co-ops in the sales of power.
- For legislation preventing sale of Dixon-Yates power over TVA lines.
- For the Niagara Power Project with preference to co-ops and other non-profit systems.
- For the Humphrey-Price Bill restoring the REA administrator's loan-making authority.

Campaigning through the depressed coal fields of West Virginia, Kennedy endorsed a national fuels policy which would give coal "an equal chance to compete," and proposed development loans and tax incentives to encourage construction of steam plants near the coal fields for export of electricity to neighboring regions.

On oil imports Kennedy has followed the straight New England consumer position. He testified before a House committee against a bill which would have imposed stricter import controls, advocating instead that quota restrictions be completely abolished. This is the position favored, of course, by the power industries which want cheap fuel. Whether he would take such a down-the-line consumer position as President, when he would no longer be representing sectional interests, remains a question.

Kennedy has voted to cut the oil depletion allowance, but favors a graduated reduction instead of a flat abolition. The oil industry voices fears that a Kennedy Administration would at least relax the restrictions on oil imports.

KENNEDY: '. . . too slow power policy'

Vice President Nixon has taken a more moderate position in general on power issues. He has supported the "no new starts" policy of President Eisenhower as a practical way of getting current projects finished without increasing the federal budget. He also says expenditures for public works should be concentrated in periods of recession when the economic stimulus is needed. At the same time he speaks of the continuing need for development of resources by the federal government where projects are too big for private industry. Nixon endorses the "partnership" idea in multi-purpose projects but asserts: "Power should be developed by that institution which can render the best service to the people at the lowest price."

On more general business issues, Kennedy and Nixon will agree on goals but differ somewhat on methods. Both will talk about the need for stimulating economic growth. Kennedy will endorse the Democratic platform's goal of increasing economic growth to 5 or 6% a year. Nixon has attacked "growthmanship"—the idea that the government must use its powers to endorse a preconceived rate of growth. But Kennedy will probably make economic growth one of the primary domestic issues of his campaign.

Power Groups Talk to Republicans

NRECA asks Republicans to emphasize federal development more than the present Administration's partnership plan

A nation-wide transmission system, unchanged REA loan policies, and accelerated federal multi-purpose development—these are the principal points that the National Rural Electric Cooperative Assn last week asked the Republican party to endorse.

Charles Robinson Jr, NRECA engineer, and Harry H. Nuttle, Maryland Statewide Co-op Assn manager, made the presentation of NRECA views to the GOP platform subcommittee on natural resources in Chicago, headed by Rep Melvin Laird (R-Wis.). The NRECA proposals differed from those made earlier to the Democrats.

Edison Electric Institute presented its views (the same as given to the Democrats, EW, June 20, p 86) through Sherman R. Knapp, president, Connecticut Light & Power Co.

NRECA and EEI spokesmen were scheduled to appear on different days, both after the *Electrical World* press time, so oral presentations were not available. Knapp's was expected to be somewhat different than the EEI statement.

NRECA Requests Continued Aid

In a nutshell, here's what NRECA asked the GOP to endorse:

- Continuation of the present policy on rural electrification loans, including 2% interest rates.
- Accelerated comprehensive development of river basins through construction of federal multi-purpose dams.
- A restatement of the GOP's 1956 policy statement in favor of federal preference laws.
- A restatement and "sharpening" of the party's 1956 statement in favor of nuclear power reactor development by rural co-ops.
- "Reappraisal" of, and less emphasis on "partnership" to develop the nation's water resources—more emphasis on federal development, regardless of whether "partnership" is involved.
- Development of a common-carrier "giant power" nation-wide transmission grid, to be financed and owned jointly by utilities, co-ops, public systems and the federal government.
- Stricter standards for federal regulatory agencies, including provisions to limit or prevent *ex parte* contacts, and more emphasis on protecting "the consumers' interest" in pending cases. NRECA also cited the recommendations of Louis J. Hector, who resigned in 1959 as a member of the Civil Aeronautics Board (EW Oct. 5, 1959, p 62).

Demos Disagree on Steam Plants

Last week's *Electrical World* report on the Democratic platform carried an inaccuracy that proved to be a clue to behind-the-scenes wrangling during the platform writing.

Early drafts of the water resources plank stated: "Foster development of efficient regional giant power systems from all sources, water, tidal, steam, and nuclear . . ." The final draft did not have the word "steam." The *Electrical World* reporter on the scene in Los Angeles said the word was deleted after a heated closed meeting of the committee in which delegates from West Virginia led objections to including steam generation in the platform.

C. Girard Davidson, chairman of the Natural Resources Committee of the Democratic National Advisory Council, insisted that the word "steam" had never been in the plank. But he added that the final wording could be construed to include thermal plants because the sentence talks about "all" sources anyway.

Objectors took the stand that thermal plants do not belong in the category of natural resources.

US-Canada Resume Meetings

Ratification of a US-Canada agreement for cooperative development of Columbia River's power resources appears unlikely this year due to differences between the British Columbia provincial government and the Canadian national government.

After a two-day meeting earlier this month in Ottawa, the delegations reported "a substantial measure of agreement was reached on important issues and it is anticipated that the negotiators will shortly be able to submit a progress report to their governments."

The International Joint Commission has recognized Canada's claim to proprietary rights to waters originating in its territory. It recommended that downstream benefits derived in the US from water storage projects in Canada be shared equally between the two countries. This means that when stabilizing and regulating the flow through works in Canada increases the power output at US sites, half the power is to be shipped back.

At issue now are what storage and control projects should be installed in Canada to increase US power production, and the terms on which they should be installed and regulated.

Here is where Canada's internal troubles enter the picture. Canada power resources belong to the provinces but control of international streams belongs to the national government. The British Columbia provincial government is interested in authorizing a big power development on the Peace River, far to the north. It is questionable whether the province's presently developed area could absorb what would be Peace River project's output and what would be Canada's share of the Columbia River power.

The Canadian federal government is interested in getting a settlement with the US quickly, to permit maximum utilization of the Columbia resources with a maximum return to Canada.

New Contracts Ruffle Labor Scene

- Picket lines idle 1,700 at Kansas City Gas & Electric
- Ohio Edison, Union Electric, Ontario Hydro in negotiations
- GE and IUE start new contract talks

A flurry of labor troubles and new contract negotiations hit the electrical industry last week.

At Kansas City Gas & Electric Co, company representatives were working with state and federal mediation commissioners to end a strike involving 1,700 outdoors, production, and clerical workers. Cause of the strike were disagreements over safety rules, working hours, wages, and pension plan features in a new contract to replace the two-year agreement that expired June 30. The union action was unexpected, since negotiations—in progress since the middle of May—were reported to have been making good progress. The union is reported to be asking a 5% increase on a one-year pact or 5% each year on a three-year pact.

The strike started July 12, when Local 1416, representing 813 outside workers, walked out, followed shortly by 380 clerical workers of Local 1613. Both posted picket lines, which the production workers refused to cross although their local had accepted the company's offer.

Under Missouri's King-Thompson law, the governor may seize and operate a strike-bound utility if the public welfare is in jeopardy. The law has been invoked seven times since its enactment. However, Lt-Gov Edward V. Long, acting for absent Governor Blair, is reported to have said he will not seize the company as long as there is no public hazard and negotiations continue.

At Ohio Edison, a strike by 520 linemen in Youngstown dwindled out in two days but gave the utility one more union to deal with, when the local voted to disassociate from the Utility Workers Union of America and to form an unaffiliated group, the Assn of Utility Workers of America.

Principal issue in the Youngstown schism is the local's refusal to go along—on a one-year trial basis—with a proposal allowing the utility to hire outside contractors.

The Youngstown local was one of three groups whose contracts all expired June 30. Ohio Edison's negotiations with seven locals of the International Brotherhood of Electrical Workers were temporarily halted when the union extended the contract to July 23 in order to evaluate the company's latest offer.

Negotiations with the joint council of the Utility Workers Union of America, involving 1,320 employees in six locals, have been settled and are awaiting ratification by the union. The two-year contract proposed by Ohio Edison offers the locals a 4% across-the-board wage increase in the first year—representing from six to 13 cents an hr increase. In the second year, another increase, in various classifications, will amount to 5.5 to 14 cents per hr, plus a better pension plan.

Wildcat Hits Union Electric

Union Electric Co, St. Louis, which was hit by a short wildcat strike the week before, is also in the middle of new contract negotiations, with its operating engineers. Representing about 1,300 workers, Local 148 (IBEW) is seeking a 10% wage hike and has already rejected the company's last offer. A strike vote has already been taken, giving the union leaders authority to call their men out if they so choose.

The brief wildcat at Union arose from a disagreement about overtime work to repair storm damage at Alton, Mo. About 65 linemen there walked off the job July 1, when the company put a limit on their overtime for safety reasons. The men wanted to work around the clock so they would have the holiday weekend free. The linemen returned to work July 4.

In Canada, the employees union of the Ontario Hydro Power Commission has announced plans to seek conciliation services after three months of contract negotiations with the Power Commission. On July 8, the union rejected a offer which the Commission said would boost total increases for top tradesmen to 5.5% since the 1959 contract adjustment. The 9,000-member affiliate of the Canadian Congress of Labour has accused the Commission of misrepresenting the facts in estimating the value of the increase.

PG&E, IBEW Contract Signed

On the West Coast, a two-year contract calling for a 4.5% general wage increase and further fringe benefits has been approved by Pacific Gas & Electric Co and the International Brotherhood of Electrical Workers. Effective July 1, the agreement covers 13,611 physical and clerical workers.

In Poughkeepsie, N. Y., Central Hudson Gas & Electric Co announced a one-year contract between the company and the International Brotherhood of Electrical Workers providing a general wage increase of 5%.

A similar agreement on wage increases and costs of health plans was reached with the Central Hudson Employees Assn, an independent organization.

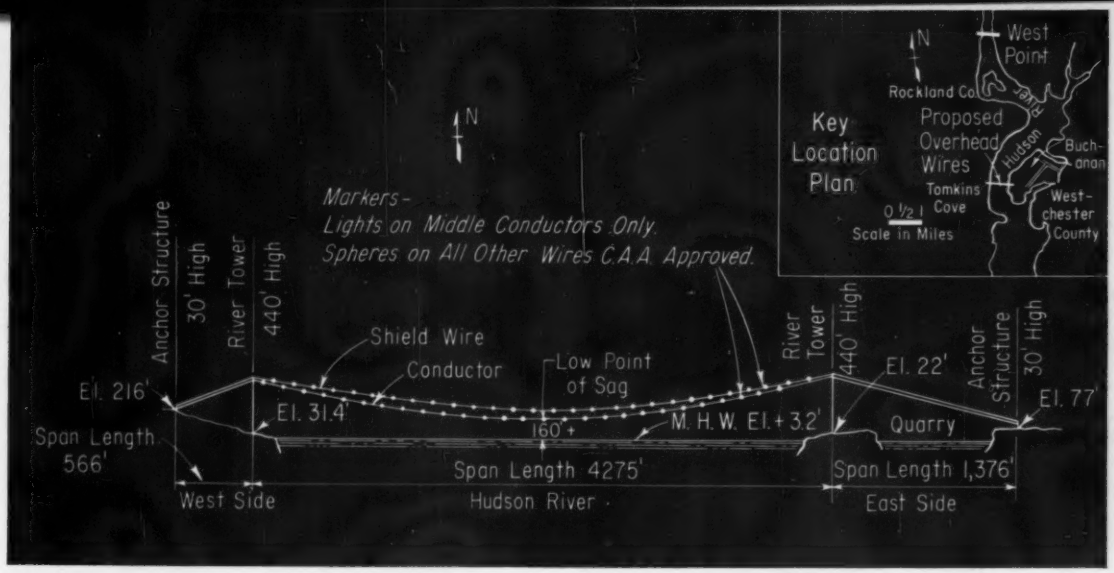
GE Union Asks 3.5% Increase

General Electric Co and the International Union of Electrical, Radio and Machine Workers (IUE) began negotiations last Tuesday on the 1960 contract. The present five-year contract with the union, which represents some 70,000 of GE's 110,000 unionized employes, expires Oct. 1 (See earlier story, p 64).

The negotiations were started almost a month early so the union and company could explore more fully the problem of employment security. The IUE is asking for a 3½% minimum wage increase plus 25¢ an hour increase for skilled worker, as well as liberalized insurance, health, and pension benefits.

The second-largest GE union, the United Electrical, Radio and Machine Workers of America (UE), presented their demands last week also. These include a 35-hour work week at 40-hr wage levels, a "substantial" wage increase, and several other benefits.

Westinghouse Electric Corp has received substantially the same demands from both unions, but negotiations have not yet begun.



230-Kv River Crossing Cable Begun

Work has begun on the 230-kv aerial cable spanning the Hudson River to link Consolidated Edison's Indian Point Nuclear Station with Orange-Rockland Utilities Co Lovett Steam Station in Rockland County, N.Y. The cable's clear span between the river's east and west shores will be 4,275 ft. Minimum clearance for shipping at mean high water will be 160 ft.

Site preparation for the west-shore 440-ft tower started July 5. Cable stringing is scheduled to begin in the fall. The 230-kv high line crossing will be operated at 138 kv.

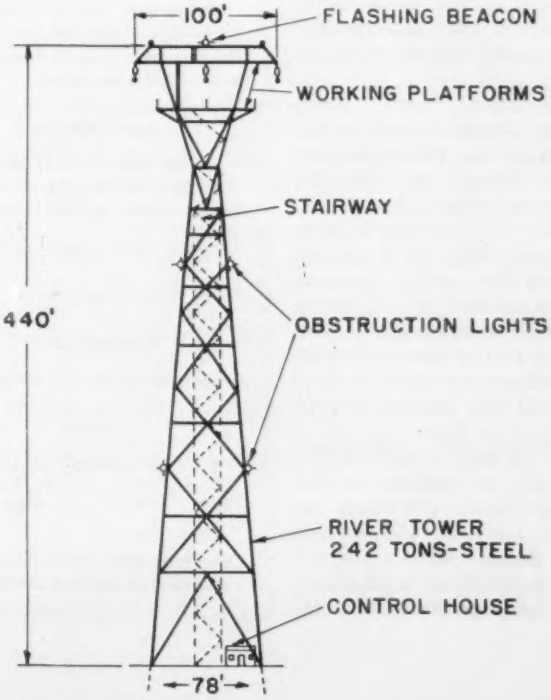
Both towers will have similar anchoring, except that the west-shore one will be anchored 566 ft back from the crossing tower site, and the east-shore one 1,376 ft. Rock footings will go down 40 ft.

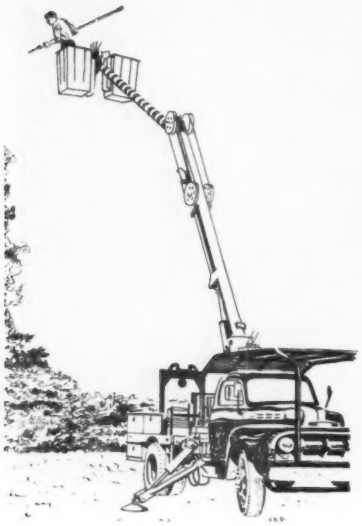
The three-phase conductors will be 957.9-MCM, ACSR 62 aluminum to 61 steel strands. Each conductor weighs 3.08 lb per ft and has a breaking strength of 123,500 lb. The two shield wires will be 37 strands of 1.01-in.-dia Alumoweld No. 7 steel which weigh 1.76 lb per ft.

Both types will be strung under tension. For the conductors, the tension will be 25,000 to 30,000 lb; for the shield wires, upwards of 20,000 lb. Each of the four tower leg angles will be 12½ x 12½ x 1⅛-in. low alloy H.S. steel (ASTM A 242) welded plate. Towers will weight 242 tons each.

Aviation safety features will include 20-in.-dia metal spheres as well as lights. The red spheres will be placed on two conductors and both shield wires, the middle or main conductor having the lights. These spheres will be placed on a 300-ft center on each cable, the individual sags and the 80-ft separation between the shield wires giving a staggered appearance at a distance.

A special cable-riding gondola will be used for their placement and maintenance. Twelve neon lights, also red, will be equally spaced along the middle conductor. They will be powered from the energized cable. Tower lights will consist of a flashing beacon at the top and two lights on each corner of the legs at two levels, roughly a third and two-thirds of the distance from the ground. Power for the tower lights and winches come from a nearby distribution line on the west shore. Consolidated Edison will install a PT for the east tower with an Mg set as an auxiliary source.





At Public Utility Fleet Managers Conference:

- Fleet men report compact cars are coming in at a fairly rapid clip, but they still must prove economy
- Advances made on lifts, derricks, and diggers
- And some revealing answers to a $64 question . . .

Who's Holding Back Aerial Lifts?

Fleet managers, representing some 30 eastern utilities, meeting in Williamsburg, Va., last month came up with some unexpected answers to their probing questions.

During the three-day, give-and-take sessions, they heard:

• Less than half of the 30 utilities represented actually own an aerial lift device for line or tree work, although there seemed to be fairly wide agreement that such devices offer labor-saving and money-saving possibilities.

• Transportation men, themselves, must accept part of the responsibility for the rather sluggish acceptance of such devices into utility fleet operations.

• Compact cars are being brought into fleets at a fairly rapid clip although many fleet managers are not fully convinced they afford greater economy than standard cars.

• At least two of the established truck manufacturers plan smaller, lighter, parcel-type vehicles for possible use in utility fleets.

• There have been advances in the safety aspects as well as in the versatility of such equipment as aerial lifts, derricks, and diggers during the past few years.

A good many of the hundreds of questions and suggestions were directed at the representatives of manufacturers, but the fleet managers did not hesitate to do a bit of soul searching when faced with the question, "Who is putting the brakes on the application of such labor-saving devices as the aerial lift?"

Replied Conference Chairman G. Fred Murphy, Appalachian Power Co, "Maybe we should bolster communications within our own companies. It is the responsibility of the transportation supervisor to keep his company informed on new equipment available."

Others suggested that more selling should be directed at overhead superintendents and engineering department personnel. Some mentioned that unions might be reluctant to permit the most efficient use of such devices.

Fleet Men Are Partly Responsible

A more comprehensive answer came from another transportation superintendent, whose utility is making wide use of such devices. "In our business there is a built-in resistance to change. Some of the resistance is based on fact. Other is not. We hear that we are hamstrung by unions. Yet, we know that our workmen are reasonable if they know the facts.

"But in every utility someone must lead the way, and much of that responsibility falls to the people around this table. The workmen

(*Continued on page* 98)

What Fleet Men Want

Utility fleet men attending the conference suggested the following improvements or changes in automotive equipment:

Aerial Devices

A lighter boom-bucket unit suitable for small service trucks and aerial ladder replacements

Stronger, better protected devices

Faster delivery schedules

Compact Cars

Better availability of parts

Trucks

Smaller, parcel-type trucks

Better shielding from radio interference

Cabs that are within the 80 in. width requirements of some states

RAPT ATTENTION to technical discussion finds CIGRE delegates in prayerful attitude as they concentrate on simultaneous translations of speaker's words into German, French, and English by battery of interpreters

At recent conference in Paris . . .

CIGRE Studies Power System Needs

18th International Conference of Large Electric Systems reveals growing need for high-capacity transmission, cables, and apparatus to match expanding networks

There is no sign of a let-up today in the movement of transmission and cable voltages into the extra high voltage ranges, but the pattern of future voltages is beginning to take shape. Pressures for higher-rated lines and switchgear are increasing as power systems expand, boost generating capacity and reach out to interconnect and exchange power with other systems and other regions.

These pressures, which are shaping future power systems in many parts of the world, were particularly apparent last month as the International Conference of Large Electric Systems (CIGRE), in Paris, drew together upwards of 1,800 top-flight power system engineers from 50 countries as far apart as India, South Africa, and Iceland.

Details of discussions that took place are reported in the following pages.

Though the conference lasted for ten days, not all the fruitful discussion at CIGRE took place in formal sessions, by any means. Nor was language a serious barrier at any time to the free flow of ideas that went on everywhere in convention corridors, in the streets, and in sidewalk cafes. Knots of engineers in earnest discussion, pencils in hand, picked up where sessions left off and carried on in the universal language of the engineering profession.

Though national barriers were down at CIGRE, a consciousness of political differences was present nevertheless. It was apparent, for example, in the reaction to a significant discussion of European interconnections by Poland's internationally-known Professor W. Szumilin, when he whittled a sharp point on the broad implications of future European EHV transmission patterns.

Europe today, said Professor Szumilin, should give serious consideration to the establishment of a 400-kv grid that would integrate the major power systems of all Europe, both East and West, if not now and not at 400-kv, then at some future date and some voltage higher than 400-kv.

Applause for the professor was generous. His proposal was dropped. There was no further discussion of it from the floor. In the corridors, however, discussion was active; not all of it was negative, by any means.

Future EHV Steps Weighed

The future of extra high voltage and the choice of new voltage steps above 400-kv drew transmission authorities at CIGRE into a discussion that was unquestionably the most significant and far-reaching of any

at Paris. Although CIGRE is a body for the exchange of views, and not a standardization organization, there can be no doubt that the clarification of opinion that took place will speed the achievement of international voltage standardization.

Two proposals were laid before CIGRE in the report of Study Committee No. 9 on EHV Transmission. One proposal was advanced by Philip Sporn and H. P. St. Clair, American Electric Power Co. They proposed three voltages above the 230-kv level: the 345-kv level of which the European 380-kv level would be a variant; a 500-kv nominal level, and finally for the distant future the 690 or 750-kv nominal level.

The other proposal, presented by P. Ailleret, Electricite de France, followed the line of former International Electrotechnical Commission (IEC) decisions regarding international voltage standards. It proposed that nominal voltage be 220-230 kv, 275-287.5 kv, 380-400 kv, 660-690 kv. The Ailleret proposal called for these voltages to be used exclusively for all new systems but it would permit continued use of interminate steps already in use.

As matters stand, four nominal levels, relatively close to one another, are being used today above the 220-230-kv level: 275-287.5 kv; 330-345 kv; 380-400 kv and 500 kv.

Discussion established clearly that it is not economical to use voltages too near each other and that the ratio between steps is not strictly defined. Voltage ratios of $\sqrt{3}$ (corresponding to capability ratios of 3-4), 2 (capabilities of 4 to 5-5) or 2.5 (capabilities of 6-8) were quoted.

Big Voltage Steps Urged

Dr G. Boll, Dr H. Roser and others representing the German utility association Deutsche Verbundgesellschaft (DVG) urged a big voltage step from 400 to 690-kv. They rejected the introduction of 440 and 500-kv nominal levels, just proposed for standardization through IEC, because it can't be used in Germany without abandoning 380 kv which is already successfully established. The 380-kv system can't be operated at 440-kv because insulation isn't enough for air pollution conditions, they point out.

G. Jancke, Swedish State Power Board, favored the 345-500-690-kv voltage sequence proposed by Sporn. However, he observed that it is hard to limit systems to two such transmission voltage values as 500 and 690 kv.

Dr C. F. Wagner, Westinghouse Electric Corp, commented that the 380-400-kv level used in Europe was adopted to get distance transmission. In the US he said, 345 kv is needed to overlay 138 kv. The proposed IEC nominal/maximum levels of 440/485 kv and 500/525 kv don't satisfy either overlaying or distance needs. "Only if we provide enough voltage steps can we discourage an even larger number," he said.

W. Casson, of England's Central Electricity Generating Board, noted existence of 500/525 kv in USSR, 460-kv tests in US and Canada, 330-345-kv in Africa, Australia and the USSR. He questioned whether Ailleret proposal can be achieved. Five levels may be necessary unless we can strike on a system not so rigid as that now before the IEC, he said.

W. Diesendorf, Snowy Mountains (Australia) Hydro-Electric Authority urged that a voltage be provided between 400 and 700 kv. To do otherwise is dangerous when research hasn't been completed at 700 kv.

Series Compensation Grows

The use of higher transmission voltages is the best way to offset the increase in transmission cost that comes with the extension of distances. However, series capacitors appears to be growing as an effective, economic means of raising stability limits of long, high-voltage transmission. A Swedish paper by B. Nordstrom, L. Norlin and R. Gradin compared all known means of raising 400-kv stability limits. They found series capacitors most efficient, convenient, flexible and cheap.

Dr E. L. Knouse told CIGRE Los Angeles Water & Power Department is considering conversion of the Hoover Dam 287.5-kv line to 380-400-kv operation using series compensation and dual conductors. Towers have enough strength for double conductors and can be operated at the higher voltage without insulation change. To use 345 kv, he said, would require more series capacitor than 380 kv.

In the USSR too, series compensation has been used on one of their large transmission lines. The 400-kv

FRENCH MINISTER OF INDUSTRY J. Jeanneney opens 18th CIGRE conference at Paris. Seated are: Philip Sporn, head of US delegation; J. Mollerhoj, head of Danish delegation; G. Silva, president; and J. Tribot-Laspier, director of CIGRE

Kuibishev-Moscow line with two single 490- and 540-mi lines is compensated with a single series-capacitor bank in the center between two bus bars of a cross-connected substation. Two other 620-mi, 400-500-kv USSR lines do not use series compensation.

B. P. Lebedev, head of the USSR delegation, said the Kuibishev-Ural Russian 500-kv transmission line was put in operation in 1959 under "peculiar voltage conditions." With 400-kv equipment still in use at the generating end, the voltage at the receiving end is higher and the line is operating temporarily with reversed slope (420-470-kv) and transmitting 900-Mw under these conditions. The second 500-kv Stalingrad-Moscow 500-kv line, also 620 mi long, has a capacity of 1,500 Mw. Since startup at 500 kv there has been little trouble.

CABLE DISCUSSION focused heavily on need for higher cable capability. K. S. Wyatt, Phelps-Dodge, above, urged resort to tailored synthetic dielectrics

New Labs Study EHV

Descriptions of the Canadian 600-kv experimental line at Coldwater and of Project EHV in the US were presented in detail. J. G. Casson and N. J. McMurtrie of Ontario Hydro described the Canadian line; P. A. Abbetti, General Electric Co, explained Project EHV at Pittsfield, Mass. McMurtrie disclosed that the Canadians have been able to make conductors gallop at an amplitude of the bundle spacing of 15-in. by raising the voltage gradient on the lines.

J. K. Dillard, Westinghouse, announced that a third test line is now being built in North America by AEP in cooperation with Westinghouse and five other firms on the system of Appalachian Electric Power Co at Applegrove, W. Va. It will be energized at 750 kv early in 1961 and will permit separate simultaneous RI and Corona loss measurements and comparisons of three conductor configurations under computer control, he said.

It appears steady-state stability is growing and transient stability is becoming less important as meshing of systems increases, particularly at high voltages because persistent faults are more rare, polyphase faults are disappearing. Progress in relaying, breakers, and reclosure has cut the importance of single-phase faults as a stability factor.

Considerable discussion developed over single vs three-phase reclosure with both sides claiming equally-good performance. Preference of European systems for single and US systems for three-phase reclosing appeared to turn on which type was first used in each case.

Desirability of reducing breaker dead-time, to the limit allowed by arc-dionization, was suggested by H. P. St. Clair, American Electric Power Co, both in discussion and in a paper with E. H. Porter. To cut down reclosure on faults a relay scheme has been used to block reclosure when a refaulting could occur. Recent new two-cycle breakers have let AEP operate one double-circuit line with one breaker at considerable saving, St. Clair said.

An analysis of all faults on all EHV transmission lines through 1958 was presented by W. Casson, CEGB, and led him to conclude that:

1. Lightning is the greatest hazard; insulation the most vulnerable component of equipment.

2. Ground wire protection is inversely proportional to shielding angle and single-circuit construction is less vulnerable to lightning than single circuits on double-circuit towers.

3. The performance of auto-reclosing is very good, on non persistent faults.

Need for greater capability from high-voltage power cables focused attention of cable experts at CIGRE on the possibilities of EHV cables with plastic dielectrics, on forced artificial cooling of cables and on thermal characteristics of soils.

New EHV Cable Dielectric

General conclusion was that high dielectric strength of impregnated plastic tapes holds out promise of new EHV cables having better thermal and dielectric loss properties than conventional materials. It was shown that forced-cooling of paper cables can increase load capability of buried cables, and cables in ducts, by as much as 50%.

Measurements on cable models using oil-impregnated high-polymer tapes, at KEMA in Holland by J. C. de Vos and J. Vermeer, show an ionization inception stress of more than twice that of oil-impregnated paper and a power factor independent of field strength up to more than 50-kv/mm. These data were taken as demonstrating the suitability of polymer plastic for cables operating above 400-kv. However Dr P. Gazzana, of Pirelli, said special paper and thin oil can give dielectric strengths of 128-kv/mm. He suggests paper still has a future. K. S. Wyatt, Phelps Dodge Copper Products emphasized the limitations of paper dielectrics above 400-kv and urged development of tailored synthetics (See EW, Jan. 25, p. 66).

Dr A. L. Williams, BICC, noted need for more information than was covered in the paper on work at KEMA. Data on long-term ac strength, chemical stability of synthetics, and the possibilities of gas are needed. L. Dominach, Cables de Lyon, urged development of new synthetic materials along the lines proposed by Wyatt.

P. Ralston and G. H. West, Ontario Hydro, showed that by using a system of water pipes adjacent to cables, load capabilities can be increased as much as 50%. But their equations are valid only for single circuit cables or widely-separated multiple circuits. J. A. Giaro, Ateliens de Constructions Electriques (Belgium), concluded from a mathematic analysis and experiment that forced air circulation in a cable shaft can cut conductor temperature about in half. C. T. Sutton and A. M. Morgan, Enfield Cables, with W. G. Hawley and others of Siemens Edison Swan (Great Britain), also concluded that current carrying capacity of a cable can be boosted by a factor of 2-3 by direct cooling the conductor using a fluid in a duct in the conductor under moderate pressure.

L. I. Komives brought out that European practice is based on needs in connection with short cable. US engineers must now get ready for long cable lengths. He said US engineers hope to offer results of Cornell EHV cable tests in two or three years that will be helpful for operation of long cable lengths.

Other means for obviating the need to cool cable were suggested by discussers. J. Banks, BICC, stressed reduction of dielectric loss. R. Tellier, Electricité de France, suggested more research in low-loss insulation and E. L. Davey pointed to merits of synthetic tape.

Cable installation that takes account of expansion is becoming more important as load growth forces utilities to use cable with very long conductors. It was observed, in discussion by H. Halperin, Commonwealth Edison Co, and others, that single core cables with large conductors have a movement that is a higher percentage of expansion than previously assumed.

Breaker Problems Weighed

Three arc-interruption problems attracted most of the attention at circuit breaker sessions in Paris: post-ac current, the interruption of capacitor currents, and the problem of short-line or "kilometric faults."

INSULATOR TESTS, discussed by J. T. Lusignan, Ohio Brass, permit coordination of puncture characteristics with established performance levels

All authors seemed agreed that post-arc current is a phenomenon experienced in air blast circuit breakers; that it doesn't play an important role in arc interruption except at high frequencies. But because post-arc conductivity can't be controlled they concluded that it is an undesirable characteristic.

The status of line and capacitor switching problems was neatly summarized by G. DeZoetin, director of KEMA. Nearly everyone believes, he said, that the only solution to the problem is a restrike-free breaker. As soon as modern breakers are made restrike free, he said, we will have no more problems with overstressed lightning arresters and no unexplained stresses leading to failure of transformers.

However, H. Witt and L. R. Bergstrom, Sweden, said in only a few cases have these surge currents caused transformer failures and many non-restrike-free breakers have given excellent performance. They proposed, therefore, that only breakers causing a response in lightning arresters, when interrupting unloaded lines, should be replaced.

The increase of short circuit capacity of existing networks has introduced a new form of critical circuit breaker stress which occurs when interrupting a short-distance (kilometric) fault in an overhead line. It is characterized by a very quick rate-of-rise of recovery voltage. At CIGRE two reports dealt with the problem. Both of them proposed the connection of a resistance of low value (500 ohms) parallel to the circuit breaker terminals or to each element.

C. W. Mott, CEGB, felt that short-line faults can be covered by high reserve breakers designed against a high rate of rise of voltage. However, A. M. Cassie, also of Great Britain, felt that the problem was not only due to rate of rise of recovery voltage but also to peculiarities of the circuit and that capacity across the breaker is the best way of dealing with the kilometric fault.

T. E. Browne and W. H. Leeds, Westinghouse Electric Corp, proposed the use of SF_6 instead of air for gas-blast breakers because it has arc extinction properties with advantages over air. Today such a breaker with a rupturing capacity of 15,000 Mva at 230-kv is available.

(*Continued on page* 94)

Cards Check Service Reliability

Linemen record data on punch cards in field; system permits detailed analysis of outages

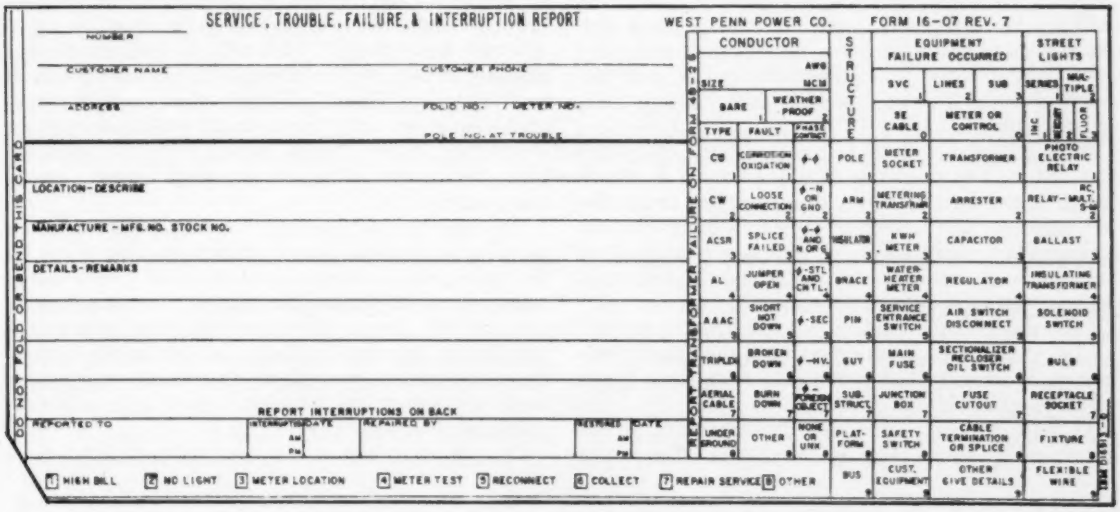
HAROLD R. McNUTT JR, District Planning Engineer, West Penn Power Co, Greensburg, Pa.

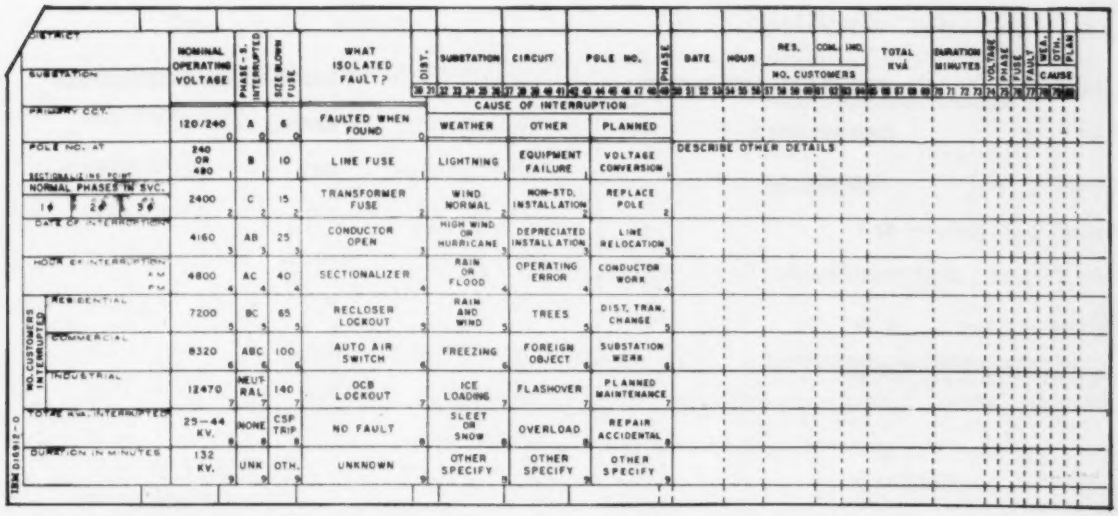
Punched card recording provides West Penn Power Co with a quick, flexible means of obtaining service reliability data. The system has been in operation for over two years and has provided a wealth of data regarding outages.

The heart of the system consists of a punched card which is marked in the field by the employee investigating the complaint. The card is characterized by a lack of ruled writing space and contains a series of items that may be reported by making an "X" in the correct box. A training program has familiarized employees with the card.

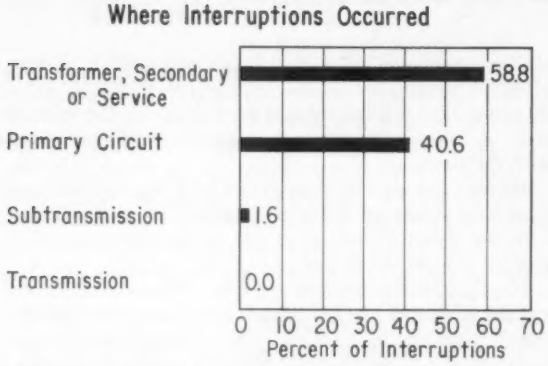
When a phone call is received in a district office, a card is immediately initiated, whether the call concerns a high bill complaint, a service outage, or any other type of customer request.

If a customer is without service, the lineman or serviceman indicates on the back of the card the station, circuit, pole number, normal phases in service, voltage, phase or phases interrupted, size of fuse blown (if any), isolating device, and what caused the interruption by





CARD FORM is marked first in office by person receiving call from customer. The same card is marked by serviceman or lineman following up the call. The card is then returned to the office where it is punched by machine



LOCATION OF FAULT is first information recorded. A majority of faults occurred on transformers and secondaries

checking the appropriate box. If the operating personnel want to elaborate any of the items, there is ruled space available for such elaboration. For example, under "Foreign Objects" they list such items as bird, squirrel, auto, etc.

After service has been restored and the completed card returned to operating headquarters, it is routed through the district operating superintendent to the district engineer. In the district engineer's office the substation and circuit are identified with a code number and the number of customers (by class) and the connected kva interrupted is entered on the card.

The duration of the interruption is inserted by subtracting the time of interruption from the time of restoration of service. This is the only calculation that is not done by machines.

As the card form is the only detailed record of the occurrence, cards are kept in the district office except when they are being punched or tabulated. The districts also maintain a log sheet on which they record general information of each occurrence by number. The purpose of the log sheet is to maintain some control over work assignments and to provide some basic information if a card is lost.

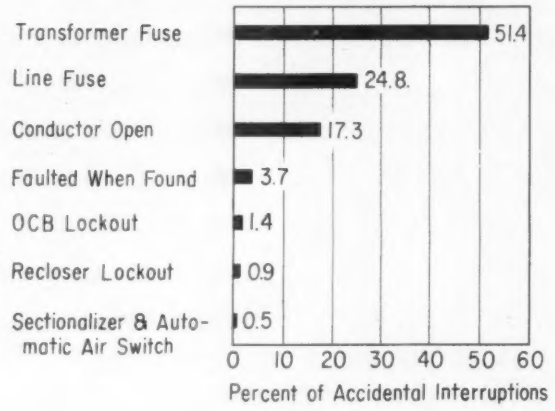
The original card on which the lineman or serviceman records the details of the callout is the same card that is punched and tabulated by machine and is then returned to the district office as a record. There is no intermediate ruled or coded form or card. Although trouble with deformed or mutilated cards was expected, there have been an insignificant number to date.

Completed cards are submitted monthly to the Machine Services Section in the General Office where the cards are keypunched, verified, calculated and tabulated. Reports are sent to each district quarterly. Comprehensive annual reports are also prepared.

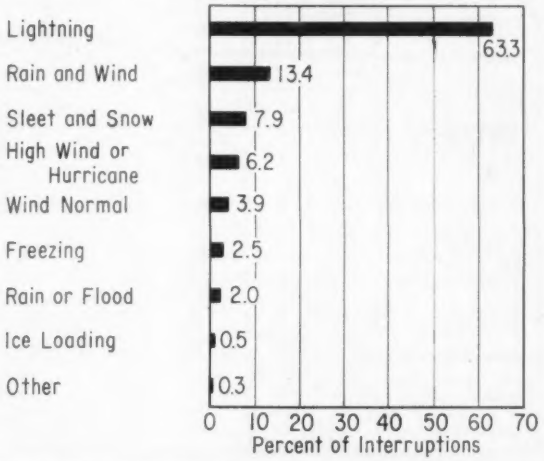
Summaries for the first 11 months of the system's operation indicated that the average interruption lasted 114 min, interrupted 117 kva of connected transformer capacity serving 34.5 customers. Charts were prepared showing what isolated the fault, what weather conditions caused the fault, frequency of other causes of interruptions, foreign objects causing fault, size of blown fuses, and causes of transformer fuse outage, among many others.

To implement the method, it was necessary to devise a coding system that would indicate precisely where on the system an interruption had occurred. Also, it was necessary to determine the number of customers by class and the connected kva on each phase behind each transformer and sectionalizing device on the system. This information is used in distribution transformer load management, to check phase load balance and to save numerous field trips.

Despite the short time the reporting method has been

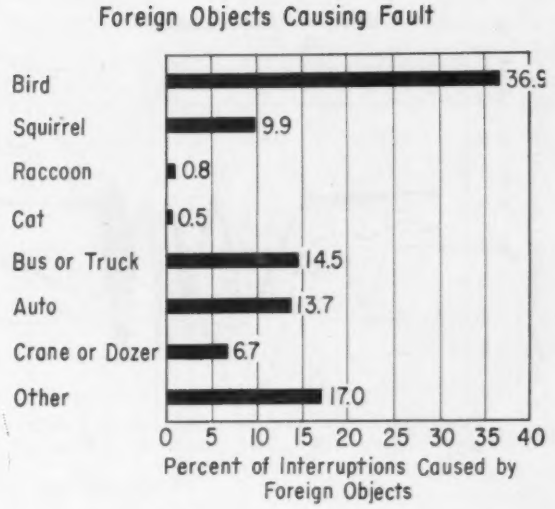


DEVICE ISOLATING FAULT is marked on the card by lineman or serviceman making call. Choices are listed on card



WEATHER CONDITIONS cause many faults. This is for weather-caused faults, not weather at time of fault

CAUSES OF FAULTS other than weather are listed on the card. Details are added when considered necessary



FOREIGN OBJECTS are common hazards. The nature of the foreign object is listed under the space for details

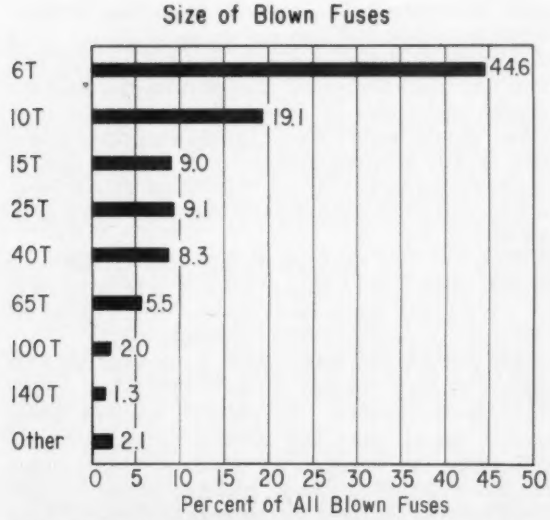
in operation, the following action has already been taken:

(1) All new distribution transformers rated 7.2 kv will be protected with either a plastic coated cover or a bushing boot. The equipping of existing distribution transformers with a boot is being studied in lieu of the high dielectric putty in present use.

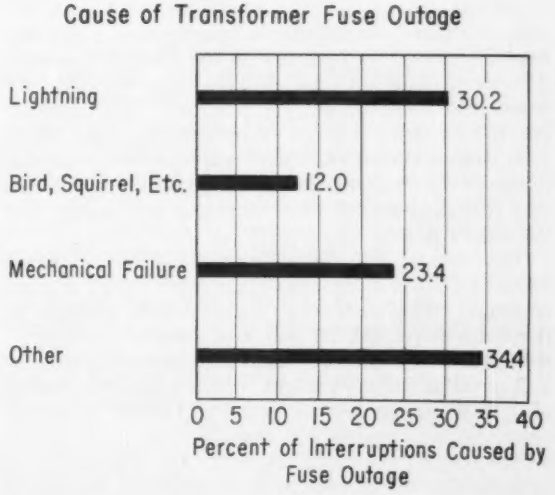
(2) The suppliers of fuse links have been made aware of the mechanical failure of fuse link problem. Some manufacturers have supplied samples of modified links that are presently under test.

(3) For several years oil sectionalizers and reclosers have been in use, but there has been no specification in writing that indicates when or where such devices should be used. There exists today a draft of a specification that will provide criteria for installing such devices.

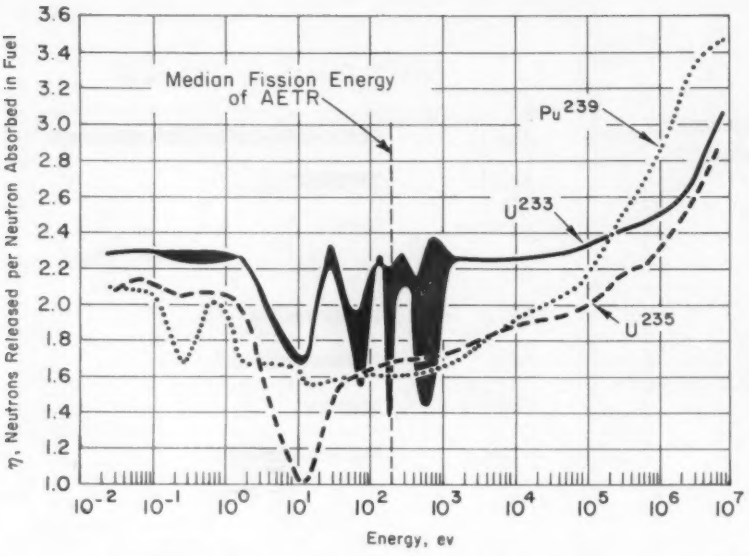
It is expected that with continuing analysis of the data, further worthwhile changes can be effected.



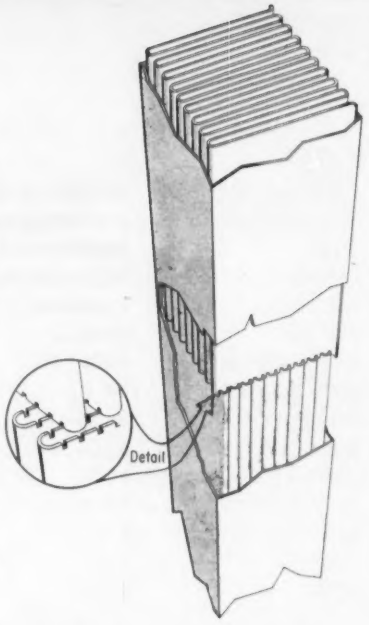
SIZE OF BLOWN FUSES prompted an investigation into the causes behind the large number of 6T fuses blown



TRANSFORMER FUSE OUTAGES, the most common isolating means, are further broken down into causes for outages



URANIUM-233 FUEL YIELDS MORE NEUTRONS PER FISSION than more widely used uranium-235 or plutonium-239 at epithermal energy range



FOLDED-PLATE FUEL ELEMENT has large surface area for heat transfer

Epithermal Reactor Shows Promise

Southwest group supports $5.3-million, two-part study of 360-Mw thorium reactor

D. T. EGGEN, Project Engineer, Atomics International Div, North American Aviation, Inc, Canoga Park, Calif.

Making nuclear power competitive in the low-fuel-cost Southwest and South is the long-range objective of the Advanced Epithermal Thorium Reactor (AETR) program, which Atomics International is pursuing for Southwest Atomic Energy Associates. To meet this aim, Atomics International is investigating a 360-Mw fission reactor that operates on the thorium-uranium-233 cycle with an epithermal—above thermal, but below fast—neutron-energy spectrum. The program covers two steps, the first completed last June: phase I, analytical studies of reactor physics and conceptual design of the nuclear power plant; phase II, experiments with a critical assembly. Both phases are limited to a laboratory scope.

The reactor will incorporate solid fuel elements cooled by liquid sodium, with stainless steel for internal structure. The moderator, if any, will be graphite or beryllium metal. AETR will have these advantages:

- High thermal efficiency from high operating temperatures. The sodium coolant, which leaves the reactor at 1,150F or higher, can generate 1,000F, 1,800-psi steam to give a thermal efficiency of 40%.
- Low sodium pressures. Because it is not necessary to pressurize the coolant to prevent boiling, the cover-gas that fills voids in the sodium loops needs to be under only 2-10 psi pressure. Low sodium pressures minimize manufacturing problems and cost.
- Compactness and high power density, with resultant low cost for the reactor structure.
- High neutron economy potentially attainable in higher-spectrum reactors, in which fewer parasitic neutron captures occur in coolant and structure than in reactors operating with thermal neutrons.

These advantages should enable low-cost power production if the following goals can be reached:

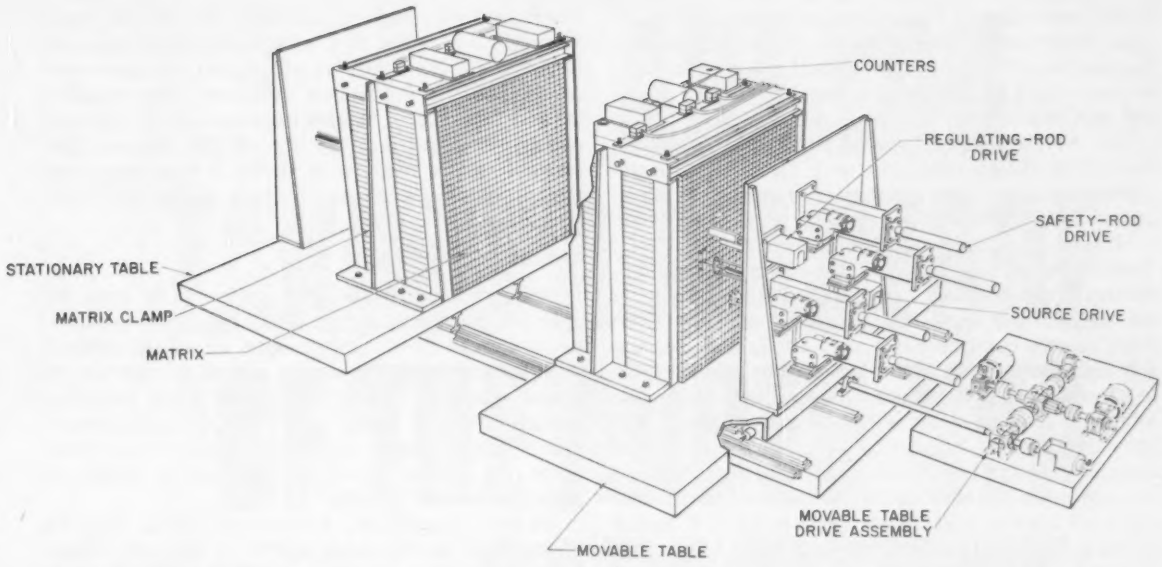
1. To avoid purchasing more than nominal amounts of makeup fissionable material, the neutron economy must be made high enough to yield a high conversion ratio, hence permit long exposure of the fuel elements (25,000-100,000 Mw-days per ton fuel).

2. Control of the reactor, with its short neutron lifetime and small fraction of delayed neutrons, must not impose restrictions on power density or add in a major way to reactor costs. Epithermal neutron lifetime of 10^{-6} sec compares with 10^{-2} sec for thermal neutrons; the small fraction, 0.27%, of delayed neutrons produced by fissioning U^{233} compares with 0.64% for U^{235}.

3. Low-cost fuel reprocessing and refabrication with remote automated techniques are still to be developed.

4. The sodium heat-transfer system will have to be fabricated and maintained at reasonable cost.

The first two problems concerning neutron behavior are the primary concern of the AETR research and development program. In phase I, research teams studied various core and blanket configurations to determine the engineering problems, performance requirements and economic potential of the reactor. Their primary emphasis was on reactor physics. They spent considerable effort on accumulation and evaluation of cross-section data.



CRITICAL ASSEMBLY TEST UNIT will start up this summer for measuring cross-sections of core materials and other unproved values. Researchers expect to confirm conclusions reached in study of the epithermal reactor concept

for Competitive Nuclear Power

Research men carried out a second major effort with a computer on a mathematical reactor model. Here they refined existing computer programs to gain full and accurate information on neutron economy in this hypothetical reactor. They made analyses to determine the importance of fast fission reactions, (n, 2n) reactions, and inelastic scattering. Carrying these analyses further, they estimated the errors that neglect of these reactions and that inaccurate cross-sections introduce in computing critical mass and breeding ratio. They also surveyed a number of reactor core designs

(*Continued on page* 54)

Why The Study Was Made

W. DONHAM CRAWFORD, Vice President, Middle South Utilities, Inc, New York, N. Y.

The hope for economical nuclear power and the desire to advance reactor technology inspired 15 investor-owned utility companies to form in 1957 the nonprofit corporation Southwest Atomic Energy Associates (SAEA) to support research toward these objectives. The companies are located in the South and Southwest where present costs of fossil fuels for power production are relatively low. Because it is more difficult for atomic power to become competitive there than in many other parts of the country, SAEA considered that the reactor of its research program must be an advanced design with high performance. The AETR concept met this need better than others.

This conclusion depended in part on anticipated but unproved favorable nuclear characteristics of U^{233}. The uncertainty was great enough to preclude immediate construction of a full-scale plant or even a pilot plant. SAEA decided upon a research and development program that emphasizes nuclear physics and critical experimentation aimed at verifying and accumulating data to evaluate the feasibility and economics of a large-scale AETR. The program, which comprises a 4½-year period of research and development at an estimated cost of $5.3 million, is being carried out under a contract with Atomics International. SAEA intends to finance the entire cost and to request the AEC only to make available special nuclear materials.

Member companies of SAEA are Arkansas Power & Light Co, Arkansas-Missouri Power Co, Central Louisiana Electric Co, Empire District Electric Co and Western Light & Telephone Co, both of Missouri, Gulf States Utilities Co of Texas, Kansas Gas & Electric Co, Kansas Power & Light Co, Louisiana Power & Light Co, Mississippi Power & Light Co, Missouri Public Service Co, New Orleans Public Service Co, Oklahoma Gas & Electric Co, Public Service Co of Oklahoma, and Southwestern Electric Power Co of Louisiana.

to see how varying the amount of moderator in the core, hence energy of the neutron spectrum, affected the neutron economy and the critical mass. The R&D men also put a secondary effort into fuel-element design and into heat-transfer and fuel-cycle analyses.

The AETR concept evolved from these evaluation studies. A design core contained Th-U fuel, sodium coolant, stainless steel structure and possibly a small amount of beryllium or graphite moderator, with a blanket containing thorium surrounding the core. The conceptual reactor would operate in the high epithermal neutron-energy range and breed U^{233} in both the core and blanket. The designers found that cylindrical reactor cores approximately 5 ft in diameter and 5 ft high could produce 900 Mw of heat, which would be transferred by secondary-loop, non-radioactive sodium to generate steam at 1,000F and 1,800 psi. The team developed a large-surface-area, folded-plate fuel element that could be refabricated remotely. Because the conceptual plant's predicted overall net thermal efficiency with a reheat steam cycle is 40%, it should produce 360 Mw of electric power. Phase I work also included experimental neutron-absorption measurements on U^{233}, U^{235}, simulated fission-products and other potential core and control materials.

Laboratory teams will conduct critical experiments of phase II to confirm the physics data and the calculation methods used in analyzing the AETR cores. They will experiment on a multiregion critical assembly to obtain empirical data on integrated cross-sections of core materials, importance functions, flux breeding ratio, and savings of blanket material over the neutron-energy range pertinent to the AETR design. The assembly will contain at its center a high-energy test region, which will be essentially a section of a full-scale U^{233}-fueled core.

Design Parameters

Output: Heat	900,000 kw
Electrical	360,000 kw
Component Design Data	
Core Tank Diameter	8.2 feet
Core	Heterogeneous
Configuration	Cylinder
Size	5 feet diameter, 5 feet high
Composition	(volume percent)
Thorium-Uranium Alloy	26.2%
Sodium	65.5
Structure and Cladding (Stainless or low alloy Steel)	8.3
Fuel Elements	
Type	Folded plate
Number	176
Sections per element	10
Sections dimensions	4 x 4 x 6 inches long
Plate thickness	0.066 inch
Plate separation	0.150 inch
Blanket	Heterogeneous
Configuration	Annular cylinder around core
Thickness	15 inches
Composition	(volume percent)
Thorium	45%
Graphite	25
Sodium	22
Structure and Cladding (Stainless or low alloy Steel)	8
Coolant Data	
Type	Sodium
Flow	89,000 gpm
Maximum velocity	27.5 ft/se
Temperature: inlet	875°F
outlet	1150°F
Steam Conditions	1000°F ,1800 psi
Nuclear Characteristics (estimated)	
Critical Mass	1100 kilograms
Breeding Ratio	1.3
Medium Fission Energy	200 kev

Critical Tests Will Start Soon

Only 25 kilograms of U^{233} are available from the AEC for these experiments. The designers, therefore, have arranged the buffer, decoupler, driver and reflector regions surrounding the central section to maintain the proper spectrum in the test region, while providing enough U^{235} fuel in the buffer and driver regions to enable the assembly to achieve criticality. Special measuring apparatus is being designed to obtain the highest sensitivity possible.

Atomics International designed the critical assembly in separable halves, which will be of the conventional honeycomb form. The firm recently finished a critical-experiment facility to house the critical assembly which is expected to go into operation late this summer. This building is at the company's nuclear field-test area in the Santa Susana Mountains northwest of Los Angeles.

Phase II will also cover research on fuel materials of particular interest for this type of reactor and hydraulic tests of fuel elements of several designs. A preliminary power plant design will be developed from the experimental and analytical data the AETR program has yielded, and a cost evaluation of this plant will be made. If the evaluation is favorable to construction, further progress will call for more component development and possibly a pilot plant.

Seek Inexpensive Reconstitution

Inexpensive reconstitution of spent fuel elements is particularly important for reactors operating on the Th-U^{233} cycle. Because the U^{233} bred in them appears combined with the radioactive isotope U^{232} and the two isotopes cannot be separated readily, the uranium fuel recycled to the reactor remains highly radioactive despite the removal of fission product activity. Therefore U^{233} fuel must be refabricated by costly remote methods. Several AEC projects aim at developing cheap reconstitution, but more effort toward this is desirable.

Experience with the Sodium Reactor Experiment, the sodium-cooled Sea Wolf reactor and Experimental Breeder Reactor I has indicated that the maintenance of sodium-cooled reactors is not difficult. Information on large-scale heat-transfer systems using sodium as coolant will be forthcoming from the Hallam Nuclear Power Facility, Experimental Breeder Reactor II and the Enrico Fermi Breeder Reactor, all currently under construction. Work performed on these projects has shown that reliable large-scale sodium heat-transfer systems can be fabricated at reasonable cost. Although maintenance costs for this equipment have not been determined over long periods of plant operation, experience with those systems that have operated and data from sodium-component development work indicate that reasonable costs should be realized within the next few years.

ARE YOU TAKING ADVANTAGE OF THE ADDED KVA CAPACITY OF GENERAL ELECTRIC'S 55°◎65° DISTRIBUTION TRANSFORMERS?

GENERAL ELECTRIC

55° 65°
75/84
37.5/42
50/56
100/112
15/16.8
25/28
5/5.6
10/11.2

Why settle for less, when . . .

General Electric Transformers give you added KVA, with the same operating life– at no price premium

Major insulation development provides 12 percent more kva capacity. Here are the facts . . .

General Electric's complete line of oil-filled 55°65° distribution transformers provides 12 percent more kva capacity—at no price increase or loss in normal operating life. This added capacity is made possible by using Permalex* insulation—a major innovation in transformer insulation systems which was developed by General Electric and is used in oil-filled distribution transformers.

The use of superior Permalex insulation permits transformer operation at higher average winding rise (65 C) without loss of normal operating life. This means you can carry 12 percent more kva with General Electric Permalex insulated transformers.

Every General Electric 55°65° transformer has a second nameplate kva rating. The new, higher rating reflects the 12 percent kva increase—allowing you to utilize the added capacity within your established loading practices. *And the new rating retains the same design margin between stated temperature rise and actual rise—consistent with traditional General Electric distribution-transformer design practices.*

General Electric's new approach to greater kva capacity is accomplished through advanced interior transformer design. Permalex transformers retain the same small size and light weight—but with substantially increased kva capacity.

Before you buy another transformer, ask your G-E Sales Engineer to show you the story of the 55°65° transformer. It takes just a few minutes and can save you many dollars in transformer investment and operation. Or, write for more information to Section 482-08, General Electric Co., Schenectady, N. Y.

*Trademark of General Electric Co.

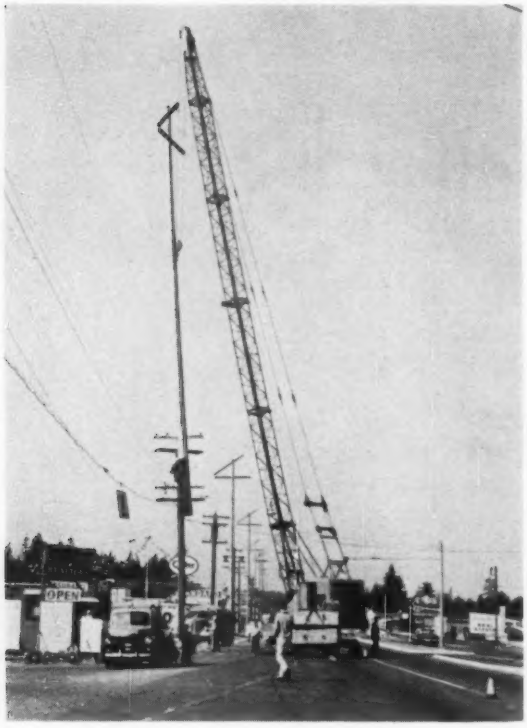
Progress Is Our Most Important Product

GENERAL ELECTRIC

COMPLETE LINE OF 55°65° POLE-TYPE TRANSFORMERS now available from G-E warehouses across the country. Instrumental in the development of this new transformer design were Dr. R. Flowers, insulation laboratory chemist and co-inventor of patented cyanoethylated kraft; J. Silverstein (front), Product Planning Specialist; and J. Leslie, insulation laboratory chemist.

Electric Utility Methods
CONSTRUCTION • OPERATION • MAINTENANCE

Crane Places 85-Ft Poles in Energized Line



Use of a 27-ton crane with 110-ft boom enabled the Snohomish County PUD to place 70 to 85-ft power poles in an energized 12.5-kv line at the rate of 11 each eight-hour day—more than double the normal rate.

Rather than tilt the poles into position as usual, the PUD decided that the poles, after having been framed with insulators and rigged with hand-lines, could be lifted above and lowered between the "live" wires on the then existing 40-ft poles. Lowering the 5,000-to 7,500-lb poles between the wires was believed to be safer and would pose less of a traffic obstruction than tilting the poles up from below.

The Roth Construction Co of Seattle was awarded the $42,000 contract to construct, with PUD materials, the 7-mile tie line from Paine Air Force Base, south along the Pacific Highway. De-energizing the existing line was impossible since it was the source of power for many businesses and homes along the highway.

A steel winch-line extending from the crane boom was fastened to the new pole at about the three-quarter mark, and the pole was then lifted above the lines. A lineman atop the original pole guided the base of the new pole down between the lines by means of a rope tied around the base of the pole. At times, when the new pole was to be placed at the mid-point of a span, guiding was accomplished from the ground.

Detect Defective Solder Seals Quickly

C. M. McCOY, Electrical Engineer, Central Illinois Light Co, Peoria, Illinois

Detection of defective solder seals on Type L bushings **before** increased power factor measurements result, increases efficiency and dependability.

The test equipment required is assembled by placing a gasketed, 3-in. diameter gauge glass over the top terminal of the bushing. A top metal cover is then clamped in place with two heavy rubber bands to provide the required compression for the test.

The bushing solder-seal test is made after assembly of the test apparatus by first partially filling the gauge glass with oil. A vacuum hose is then connected to the fitting on the top metal cover and to the intake manifold of a car or a truck. When the car or truck engine is started, a vacuum is drawn on the gauge glass. If air bubbles appear in the oil as the vacuum is drawn, the bushing seal is defective.

It's This "One-Piece" Jaw

That Does the Trick in FARGO Automatic Line Splices

And Here's Why:

Precision machining of the "one-piece" jaw from solid bar stock assures *permanent alignment* of jaw segments, which prevents individual strands of the conductor from getting out of place.

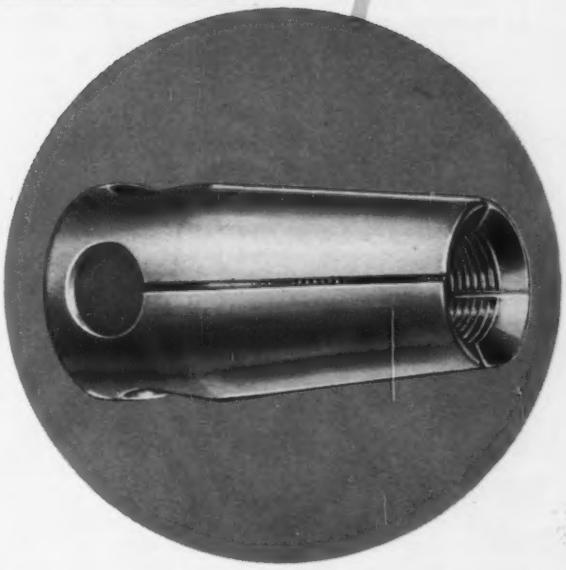
Because of "one-piece" construction, jaw segments flair out slightly as the wire is inserted to give an excellent initial grip on the wire.

The entire jaw assembly and conductor move forward as a unit when tension is applied to complete the grip—so it can't let go!

The "one-piece" jaw permits a liberal safety zone to be machined into the back of the jaw to accommodate burred ends of the conductor.

For copper conductors the "one piece" jaw is machined from durable silicon bronze . . . for aluminum and aluminum alloy conductors from a high strength aluminum alloy for a strong, permanent, corrosion resistant grip on the conductor.

Ask your Line Material Field Engineer for complete details.



Fargo Automatic Line Splices . . . Reducing Splices . . . Automatic Dead Ends are available in copper and aluminum for copper, Copperweld, aluminum and aluminum alloy conductors for a complete range of sizes.

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McGraw-Edison Company
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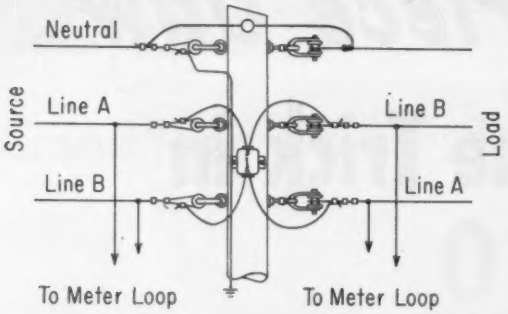
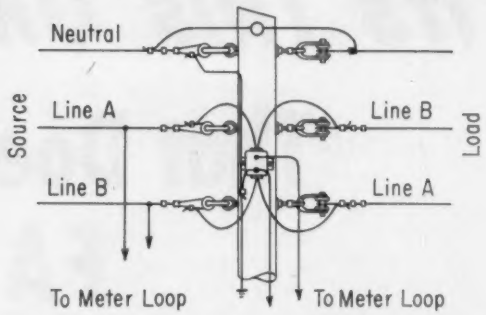


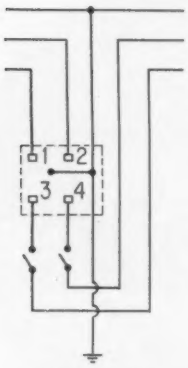


STEP 1—With service deenergized, install CT with hole vertical. Run insulated jumper from Line A, source side (center position) **down** through the transformer hole to Line A, load side (lowest position). **STEP 2**—Run insulated jumper (also wrap with plastic tape or spiral sleeving) from Line B, source side (lowest position) **up** through the transformer hole to Line B, load side (center position). If triplex cable is used, compression splices on connections should be alternated

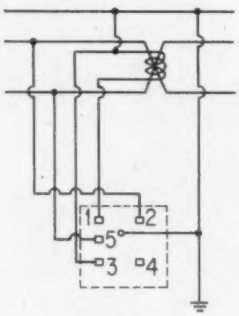
Uprate Yard Pole Meter Loops

Adapted from Bulletin 161-21 issued by the Rural Electrification Administration

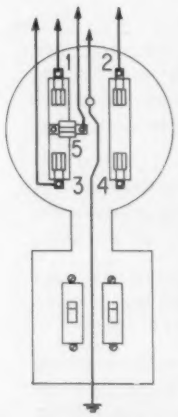
Present yard pole meter loops of 35, 50, 60 and 70-amp capacity can be reconnected for 200-amp service. As the present conduit, meter socket and wiring have little salvage value, these materials should be used, if possible, in the conversion.



Circuit Diagram
Before Conversion



Circuit Diagram
After Conversion



STEP 3—Remove load wires coming up from meter loop to metered side of line and connect them to the secondary terminals of the CT. Ground one terminal to the neutral. Remove shorting clip from transformer secondary terminals. Make certain the leads from source side of Line A and Line B to meter loop are connected. **STEP 4**—Replace the left terminal block of the watthour meter socket with one having the 'fifth' terminal. An automatic circuit closing block may be used. The wire formerly on terminal (1) must be connected to new terminal (5). Wire on terminal (2) remains connected to (2). Wire on terminal (3) is reconnected to (3). Wire formerly on terminal (4) must be connected to terminal (1)

Transformer Nameplate Ratio	Normal Two-wire Connection		Three-wire Connection (as in this conversion)	
	Max. Current Amp*	Meter Multiplier	Max. Current Amp*	Meter Multiplier
200:5	400	40	200	20
400:5	800	80	400	40

*Transformers with thermal ratings of 200% of nameplate.

Reconnection is made by installing one through-type current transformer (in a 3-wire connection), modifying the socket to provide an additional meter terminal, reconnecting the wiring and installing a 2-wire, 240-v, transformer-rated watthour meter. The current transformer and materials (excluding the watthour meter) cost about $30 to $50, depending on the size CT used. With a ratio of 200:5 on the CT, this conversion will have 200-amp capacity with accuracy comparable to a self-contained meter having only 100-amp capacity.

The conversion does not provide for yard pole breakers on the meter pole. With service capacities in the 100-amp and 200-amp ranges, breakers provide little or no protection to the service transformer. It is recommended that breakers (or fuses) not be installed. Modern primary fuses of the dual element design, if properly selected for the transformer, will adequately protect the transformer from both short circuits and overloads.

After conversion, terminals (2) and (5) are potential connections and will have 240 v across them. Terminals (1) and (3) are current terminals from the transformer. Terminal (4) is not used.

Install a 2.5-amp, 240-v, 2-wire transformer-rated watthour meter. Energize the service. Test conversion by turning on consumer's range or other high-demand, 240-v appliance. If meter runs backward, reverse connections on the current transformer secondary. Repeat test if connections are changed to ascertain that final rotation is correct.

5 BIG ADVANTAGES OF THE NEW YORK-HOOVER SPECIAL RANGER SERIES EQUIPPED WITH PITMAN *"POLECAT"* DERRICK AND DIGGER

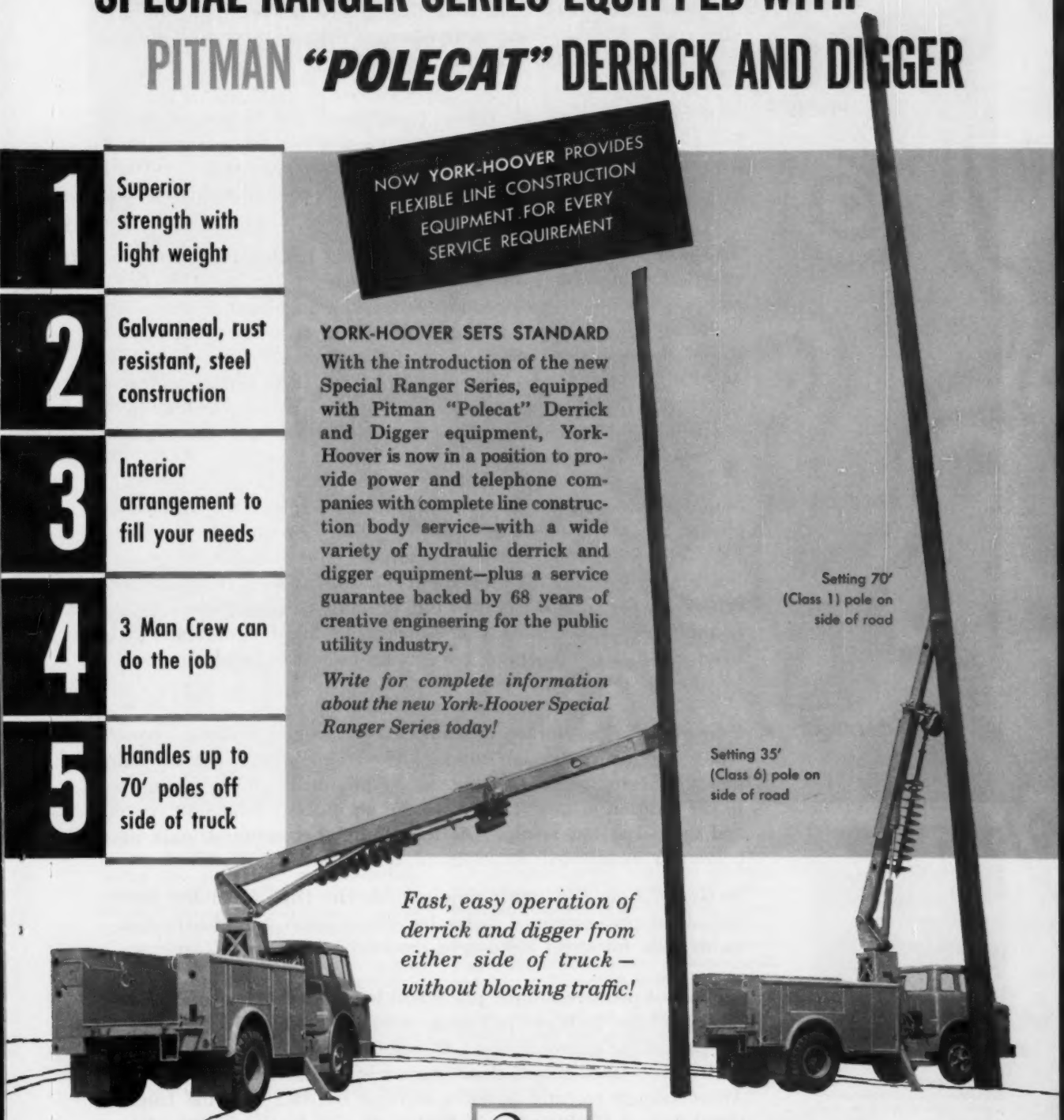
1	Superior strength with light weight
2	Galvanneal, rust resistant, steel construction
3	Interior arrangement to fill your needs
4	3 Man Crew can do the job
5	Handles up to 70′ poles off side of truck

NOW YORK-HOOVER PROVIDES FLEXIBLE LINE CONSTRUCTION EQUIPMENT FOR EVERY SERVICE REQUIREMENT

YORK-HOOVER SETS STANDARD

With the introduction of the new Special Ranger Series, equipped with Pitman "Polecat" Derrick and Digger equipment, York-Hoover is now in a position to provide power and telephone companies with complete line construction body service—with a wide variety of hydraulic derrick and digger equipment—plus a service guarantee backed by 68 years of creative engineering for the public utility industry.

Write for complete information about the new York-Hoover Special Ranger Series today!



Fast, easy operation of derrick and digger from either side of truck — without blocking traffic!

YORK-HOOVER CORPORATION

BODY DIVISION

YORK, PENNSYLVANIA

Distributors for Telelect and Pitman Equipment

Procurement & Products

OUTLOOK ▶ **Turnup in prices is in the wind in two distribution product** areas following months of depressed prices. Reason, say manufacturers, is that market-generated price levels have fallen below production and sales costs. This is forcing a decision on the part of some either to raise prices or to suffer operating losses.

PRICES ▶ **New higher price tag on 50-kvar capacitors is one barometer** that is being closely watched. Early indications are that the new $99/unit tag is holding, but it may take some weeks of testing to know for sure. If it does, it should give purchasing agents more confidence in price tags on this product than they've had in years.

The need to restore confidence in price tags reaches far outside the electrical equipment field. Purchasing Week, a McGraw-Hill magazine, reports this lack of confidence in prices is plaguing steel warehouses, copper and brass mills, plumbing supply companies and electronic component makers. In an effort to gain back the lost confidence, says PW, vendors are revising book prices to reflect market-generated prices, simplifying cumbersome discount plans and structures, studying and changing old "extra" charges, and smoothing out regional differences.

PROCEDURE ▶ **Manufacturers consider a more comprehensive role** in the addition of capital facilities. The big three have been discussing with Texas Electric Service the possibility of a turnkey-type contract for the addition of a new generating unit to the company's system. Final negotiations are expected in the near future. Recently General Electric Co announced that it would be prime contractor for the combined cycle steam-gas turbine generator unit to be built for Oklahoma Gas & Electric Co (EW, June 29, p 39).

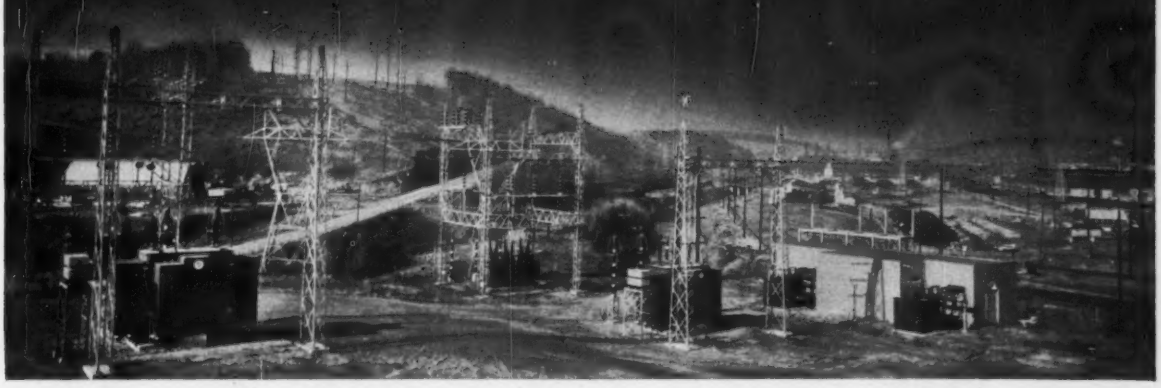
PRODUCTS ▶ **Pennsylvania Transformer announces a 12% higher loading** for pole-type transformers through 100 kva, 18 kv and below. The company said it "will continue to cooperate with established industry committees in the creation of new standards based on modern insulation systems and up-to-date test results." At least four other manufacturers have previously announced upratings of distribution transformers.

McGraw-Edison Co's newly acquired Alrectic Div of Handley-Brown had developed octagonal poles for transmission and distribution—rather than for street lighting as reported in our July 11 issue.

LABOR ▶ **Additional pressure to raise prices will build up** unless manufacturers can keep wage increases in balance with productivity increases. This is a part of the approach that GE is making to its employees as a preliminary to labor negotiations this summer and fall (see page 64). Allis-Chalmers recently signed a two-year contract with the International Assn of Machinists at its York works (Hydraulic Div) providing hourly employees with an across-the-board 2½% per year pay increase.

to carry load peaks economically... Lukens Steel chose Pennsylvania triple-rated transformers

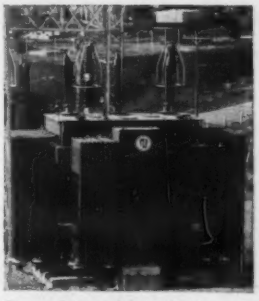
Two 30/40/50-mva units serve 25-million kwhr monthly load



Power needs at Lukens Steel Company's Coatesville, Pa., plant vary considerably during the three-shift, round-the-clock production of steel plates, heads and plate shapes. The total monthly consumption of 25-million kwhr represents an average load of more than 2500 kw—with a half-hour power demand of approximately 55,000 kw.

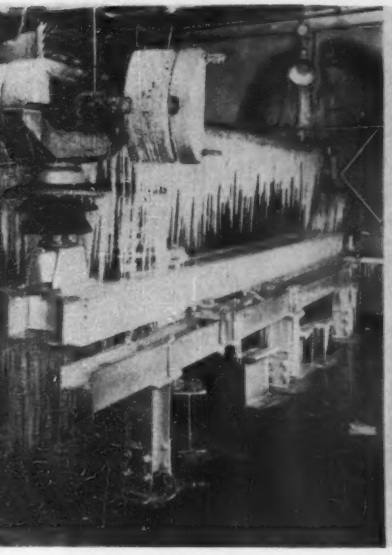
To carry load peaks economically, Lukens Steel equipped its substation with two *triple-rated* Pennsylvania power transformers. The self-cooled rating of 30 mva is automatically increased, when required, to forced-air ratings of 40 and 50 mva. Fans are actuated automatically when plant activity necessitates the additional transformer capacity.

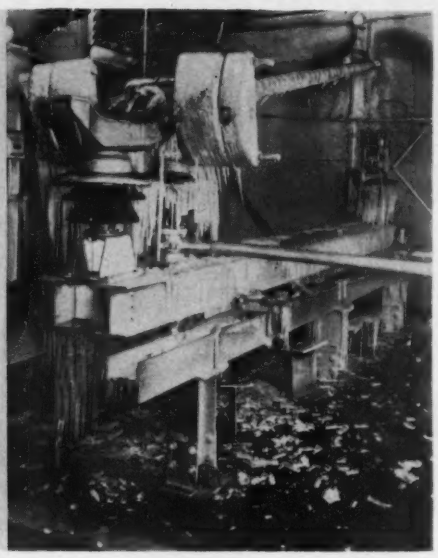
Both transformers have the inherent ruggedness needed to withstand sudden load surges. One transformer supplies power to a 100-ton electric arc furnace installation. The other handles general plant load plus the load of a slabbing mill and four rolling mills—including a 206-inch rolling mill capable of producing the widest and heaviest steel plate in the world. Under emergency conditions, the second transformer supplies the electric furnace bus in addition to handling its normal load.



One of two 30/40/50-mva Pennsylvania Power Transformers serving the Coatesville plant of Lukens Steel Company. High voltage: 138,000Δ volts, with two 2½%± full-capacity taps. Low voltage: 13,800Y/7980 volts.

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY • CANONSBURG, PA. • Greater Pittsburgh District





345-Kv Switch Ice-Tested

Delta-Star Electric recently successfully tested a 345-kv, 1,600-amp Type MK-40 vertical-break air switch under ice conditions within a freezer chamber (above). Tests were conducted in the high-voltage Chicago laboratory of the company, a division of H. K. Porter Co, Inc.

The photo (far left) shows 345-kv switch frozen under ¾-in. of thick ice. The other shows how switch breaks ice and opens successfully. Closing followed same procedure. Switch's live parts were mounted on three insulator stacks, only one insulator high. (The high-voltage power switch normally stands on three insulator stacks, seven high, is 24 ft, 9 in. high with blade open. The steel base was elevated off the floor to allow clearance for the rotating bearing, extending below the base, and to permit hanging ice formations in simulation of actual field installation.

Counter weights were used in place of hinge counter balance springs. The 12-ft blade could not be fully opened inside the freezer.

In accordance with NEMA Standards requirements for ice-testing high-voltage switches, the single-phase unit, in closed position, was sprayed for one hour with water and room temperature both 33F. Room temperature was then dropped to 25F and spraying continued at 33F for approximately four hours.

When ice thickness was at required ¾-in., spray was stopped and the room held at 20 to 25F until switch surface and ice were equalized to a constant temperature. Then the opening test was performed. Later, the closing test was made, following the same procedure.

Successful operation from both positions demonstrated ability of this leverless, linkless, and braidless switch design to operate under the worst field conditions.

General Electric Terms Union Demands 'Astronomical'

It appears that General Electric may meet with International Union of Electrical Workers earlier than scheduled to start negotiations for a new contract. Usual date is mid-August; at press time it was not determined whether GE and IUE could agree on an earlier date. Five-year pact expires October 1.

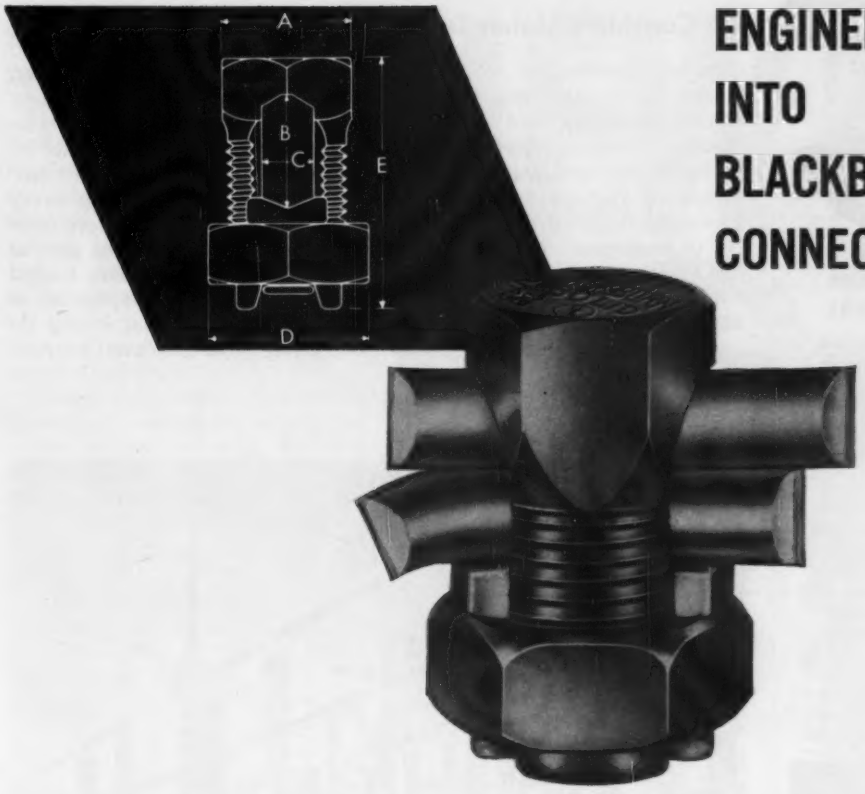
However, contract demands were termed "astronomical" by GE, with cost of union demands for the next two years running somewhere between $500 and $700 million. Mutual exploration of any grass root opportunities to improve employment continuity was urged. A firm offer will be made, GE said, when the appropriate time comes, adding that it will not be holding back some details to later use them "in the outmoded type of bargaining which simply seeks to satisfy some fancied political needs of one or more union officials." Whatever the union strategy, said GE, it is evident that union demands will again this year come way down in actual bargaining.

Serious conflict was indicated by GE as "likely to arise." This would stem from "determination of the point beyond which the addition of further costs would subtract from job security by making sufficiently attractive prices impossible—and by thus compounding the foreign and domestic competitive challenges which are so much a part of the 1960 problem of the company."

GE saw a thoroughly constructive and reasonable collective bargaining atmosphere emerging only "if the stated union objectives could really be taken at face value and if the price tag on union proposal could somehow go away."

Noting that, today, problems affecting negotiations are altered from only a short time ago, GE commented that the day has come when the public will awake and resist higher price levels forced by the (postwar) inflationary settlements. There may be the "customer strike . . . which can be permanent," said GE. With greatly improved equip-

(*Continued on page* 66)



ENGINEERED INTO BLACKBURN CONNECTORS...

REUSABILITY!

The big difference in Blackburn connectors starts with the way they are made. The basic material is high strength duronze, a silicon bronze alloy stronger than many structural steels.

High percentage of threads, both bolt and nut, plus proper selection of materials, reduces friction, increases thread efficiency and clamping force—clamping force is maintained on the conductors. Blackburn's strict inspection assures uniform high quality.

Blackburn connectors give better performance electrically. The greater thread efficiency provides a high clamping force that helps break through oxides on the conductor and improves conductivity. This high initial conductivity is maintained permanently.

Because of the better materials, precision workmanship and careful inspection, Blackburn connectors are reusable . . . over and over. Write for samples.

LIVE BETTER ELECTRICALLY

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"We like to do business with the Fanner Superformed Folks"... PURCHASING AGENT

"Our transmission-line construction is done on a 'bid-job' basis. But we insist on reliable sources for *every item* of work and equipment, because we must protect customer service and large investments.

"Take even a relatively small item, like connecting materials . . . we find that the Fanner folks, both Factory and Agent, are the kind we like to deal with. They *measure up* . . . Quality, Service, Price, Performance . . . and, above all, *INTEGRITY*."

No one knows better, than a Purchasing Agent, "Who's Who" among the Suppliers.

A-1607A

FANNER
Superformed* with a
"PROTECTIVE TWIST"

ARMOR RODS...
Protect long-span T&D lines at supports

LINEGUARDS...
Protect short-span T&D lines at supports

PATCH RODS...
Repair damaged conductors

TAP ARMOR...
Protects conductor at tapping points

FANNGRIPS...
For dead-ending strands and conductors

FANNSPLICES...
Join two ends of conductor wire

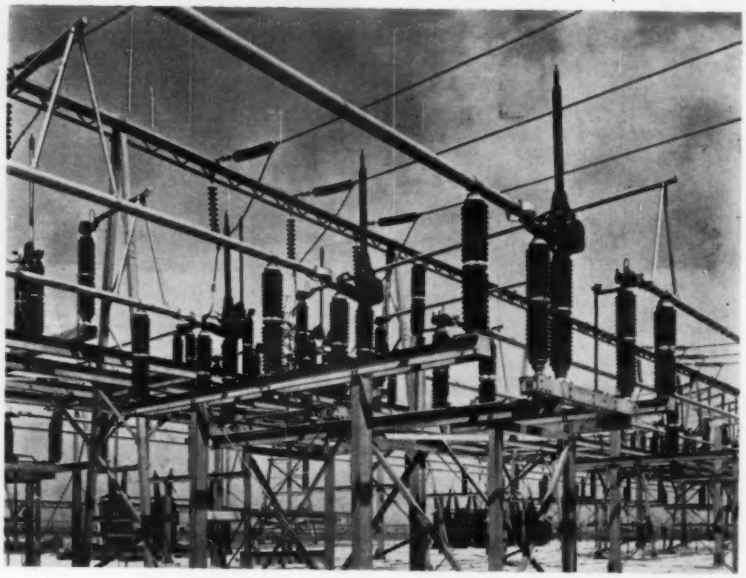
PLASTIC PRODUCTS...
For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

GE Considers Union Demands (*Continued from page* 64)

ment and facilities for process efficiency and product quality, fewer employees are required each year. "Unless a company manages to increase its sales substantially in each successive year, it will inevitably provide work for a diminishing number of employees. In our competitive environment a business can no longer continue to survive if its volume remains constant."

GE, acknowledging that there is a possibility of a strike in October, said that some competitors have been helping warn its customers as to the supposed certainty of such an occurrence. As a result, some customers have been ordering heavy equipment from competitors they consider more likely to be able to make delivery, others have bought ahead. GE has been explaining to those who inquire that it will do everything possible to avert a strike.



High-Rated 161-Kv Switches Installed

High momentary rating is featured by 23 161-kv disconnect switches, which Hubbard & Co's Three E div developed for Consumers Power Co's 265-Mw Dan E. Karn substation near Bay City, Mich. Two of the switches are 3,000 amp, the others 2,000 amp (above).

The switches have a momentary current rating well in excess of 100,000 amp, enabling them to withstand the kind of momentary surge currents possible with today's large inter-connected systems. During development by Three E, the prototype switch withstood tests of 120,000 amp.

Key to the high momentary rating of the switches is the exclusive double-locking action of the switch blade. Current flow is arranged so that magnetic forces tend to drive the blade down into contact, instead of up and out of contact.

The substation has two main bus runs and a transfer bus run. Three outgoing lines, through proper switching, can be supplied from main buses or transfer buses.

Each 3,000-amp disconnect switch serves as a bus sectionalizing switch and is equipped with a grounding blade. The 2,000-amp switches are used as line disconnects from a transfer bus and as combination line transfer switches and breaker disconnects from the main bus. Policing cams hold blade closed during high momentary current transients.

Two Companies Unite to Sell Aluminum Pole Brackets

Oliver Electrical Mfg Co and Pfaff & Kendall have launched a joint program for expanded sale of the latter's aluminum pole lighting brackets to the public utility street lighting market. The complete P & K wood pole bracket line of standard models and special designs for steel and concrete mounts has been added to Oliver's pole line hardware products.

Oliver will channel distribution through its warehouses across the nation, which will stock standard models. Salesmen in branch offices will actively promote the line.

The P & K aluminum bracket line features use of tapered elliptical design that "more than meets" NEMA and EEI specifications, as well as standard pipe design. Models to support all contemporary luminaries are available.

MANUFACTURERS BRIEFS

In recognition of his new design for large steam turbine-generators, **Allis-Chalmers** recently presented W. L. Ringland with a silver medallion, a certificate, and $5,000. It was the first such award made by the company. Ringland's new design involves an invention for a new method of transposing generator conductors—540 deg instead of the usual 360, thereby reducing eddy current losses. His invention was granted a patent in 1958 and has been licensed to other manufacturers of electric generators.

Allis-Chalmers has granted the French firm, Societe Rateau, exclusive license to make, use, and sell nuclear reactors and power plants in France and associated territories. SR was one of the first large French companies which became interested in industrial problems originating from nuclear energy.

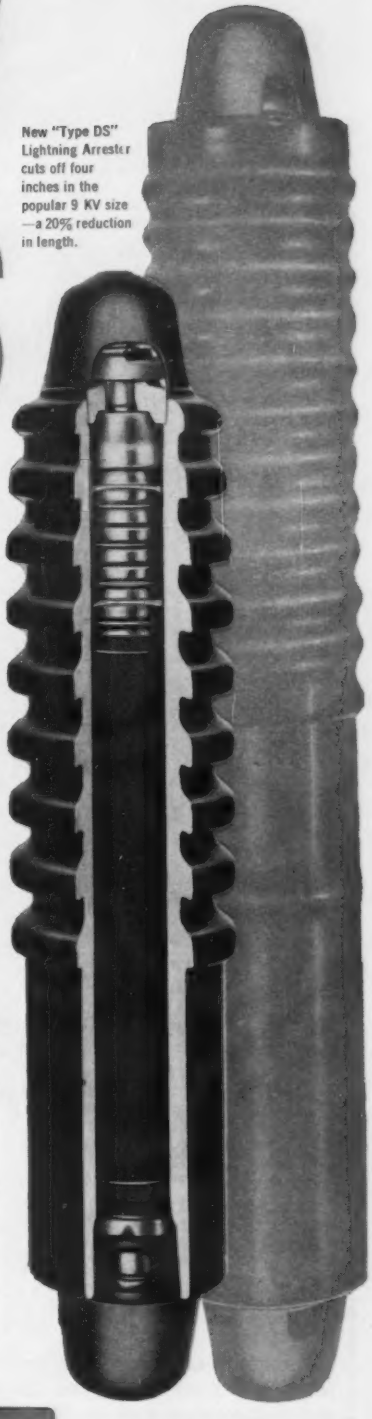
Wagner Electric will expand its distribution transformer facilities by building a 262,000-sq-ft plant in St. Louis plant. Move will consolidate all company's operation for this line, enlarging and modernizing plant.

(*More Procurement & Products, p* 68)

NEW DS

DELTA-STAR CRYSTAL VALVE LIGHTNING ARRESTER

- **20% Shorter**
- **Balanced Design**
- **Easier to Handle**
- **Lower Discharge Voltages**



New "Type DS" Lightning Arrester cuts off four inches in the popular 9 KV size —a 20% reduction in length.

The new "Type DS" Crystal Valve Lightning Arresters are shorter and lighter, for easier handling and installation. Size and weight savings have been achieved while keeping the "Balanced Design" which has made Delta-Star Crystal Valve Arresters top performers for thirty-five years.

For complete information on the new, easier-to-install "Type DS" Crystal Valve Lightning Arresters, write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 W. Fulton St., Chicago 12, Illinois.*

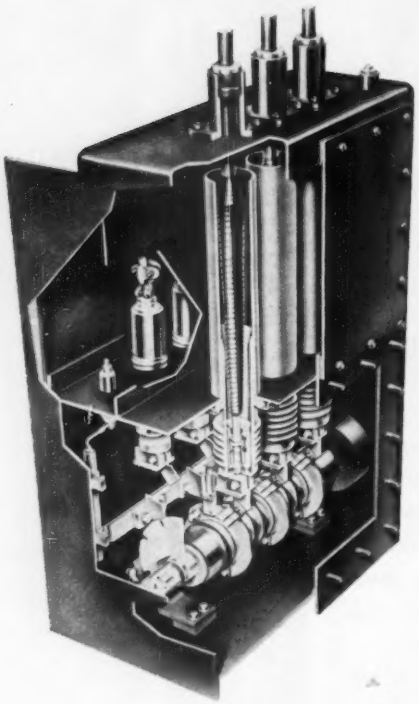
DELTA-STAR PORTER ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Transformer . . .

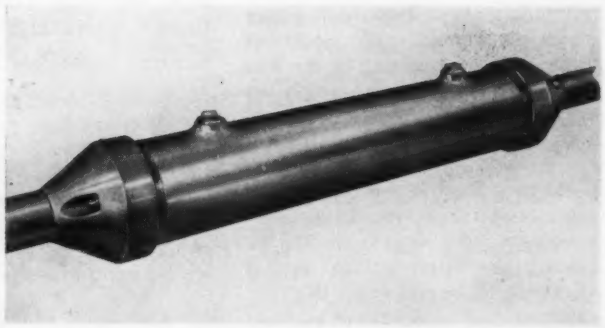
. . . gives quiet operation because core and coils are isolated from the three-piece case, which has knockouts in its sides and bottom for standard-size conduits. Coil wire is insulated with high-temperature epoxy film. The ventilated dry-type transformers are rated at 3-50 kva, single-phase, to 600 v.
Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



Bushing . . .

. . . for 15 kv and below can be used with lead, rubber and other unshielded cables. The bayonet-type bushing is furnished with network transformers. Submersible terminal chamber can be used without compounds as it has adequate insulation strength with air. Plug-in connector fits into contacts rated at 400 amp continuous and 15,000 amp for 5 sec.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Cable Joint Kits . . .



. . . require no soldering or welding for attaching to cable sheaths, but depend instead on "O"-rings and compression gaskets. The kits are for making pressure-tight joints for oil or gas-filled low and medium-pressure aluminum-sheathed cables to 5½ in. OD.
G&W Electric Specialty Co, 3500 W 127th St, Blue Island, Ill.

(*More New Equipment on page* 70)

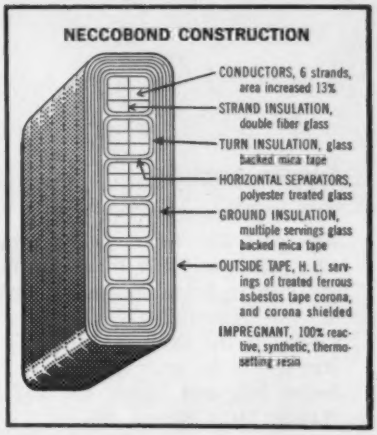
NECCOBOND...another forward step in uprating generator capacity

This 18,750 KVA, 6600 volt, 112.5 rpm, 3 phase waterwheel generator was recently rewound—and uprated—because NECCOBOND insulation system has inherently better thermal conductivity, higher operating temperature properties and permits better utilization of slot space.

National redesigned and manufactured the coils to take advantage of the NECCOBOND system—using mica and glass, impregnated with a special 100% reactive resin into a solid, voidless insulation wall.

Results—the rewound generator can be uprated in capacity without increasing the stator temperature rise. Coils fit perfectly, and did not have to be heated for installation, and no dry-out was required.

For top performance in electric coils or repair service call National.


NECCOBOND CONSTRUCTION
CONDUCTORS, 6 strands, area increased 13%
STRAND INSULATION, double fiber glass
TURN INSULATION, glass backed mica tape
HORIZONTAL SEPARATORS, polyester treated glass
GROUND INSULATION, multiple servings glass backed mica tape
OUTSIDE TAPE, H. L. servings of treated ferrous asbestos tape corona, and corona shielded
IMPREGNANT, 100% reactive, synthetic, thermo-setting resin

National Electric Coil

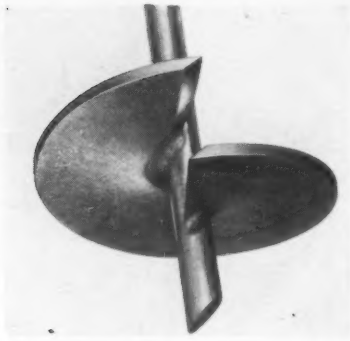
DIVISION OF McGRAW-EDISON COMPANY • COLUMBUS 16, OHIO

Electrical Engineers • Manufacturers of Electrical Coils, Insulation, Lifting Magnets
Redesigning and Repairing of Rotating Electrical Machines

McGRAW EDISON

Alarm System . . .

. . . with microwave transmission monitors as many as 24 stations with up to 20 functions at each station. A high temperature device, illegal entry detector or other alarm device at a monitored station causes an alarm at a master station to be actuated. The master station operator can interrogate the sending station to learn which point has alarmed.
Motorola Inc, 4501 W Augusta Blvd, Chicago 51, Ill.



Screw Anchor . . .

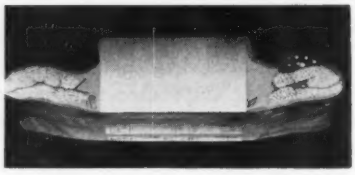
. . . is galvanized for corrosion resistance. The helix' sharp cutting edge makes installation easy, and its chisel point helps the anchor work its way around rocks. The helix is welded to the shaft in an inert-gas atmosphere for strength.
Joslyn Mfg and Supply Co, 155 N Wacker Dr, Chicago, Ill.

Battery Chargers . . .

. . . for 6 to 60-cell batteries charge discharged batteries at high rates and supply trickle charges for batteries floating. The largest model of these Hi-Lo chargers provides automatic regulation of charging rate and is rated at 6 amp for 60-cell batteries. Three smaller units, rated at 3 amp each, have manual high-low switches for selection of charging rate, but can be equipped with automatic control apparatus.
Electric Storage Battery Co, Rising Sun and Adams Ave, Philadelphia 20, Pa.

Deaerating Heaters . . .

. . . for small and medium-size plants deliver up to 100,000 lb of quality boiler feed water per hour. The "UNI-PAC" deaerator, factory assembled, maintains oxygen content at less than 7 ppb. Without entering the heater, a man can remove its water distributors for inspection.
Cochrane Corp, 261 Madison Ave, New York 16, N. Y.



Motors . . .

. . . with epoxy insulation are furnished in ratings from 1 to 500 hp. Form-wound motors have Epa-Seal epoxy resin applied to core and frame before winding; slot cells are epoxy-glass; coils are covered with glass tape; and slot sections are protected by an epoxy-mica wrapper. The completed stator, with coils installed, is impregnated with epoxy resin. Random-wound motors also are encapsulated with epoxy resin.
Crocker-Wheeler Div, Elliott Co, Jeannette, Pa.

More New Products

Combination **phase sequence indicator** and ground fault detector (Detekta-Faze), weighing 11 oz, enables operator to predetermine the direction of rotation for motors without starting the equipment. It has no switches, moving parts, or batteries.—The Glo-Lite Instrument Co, 428 Peshine Ave, Newark 12, N. J.

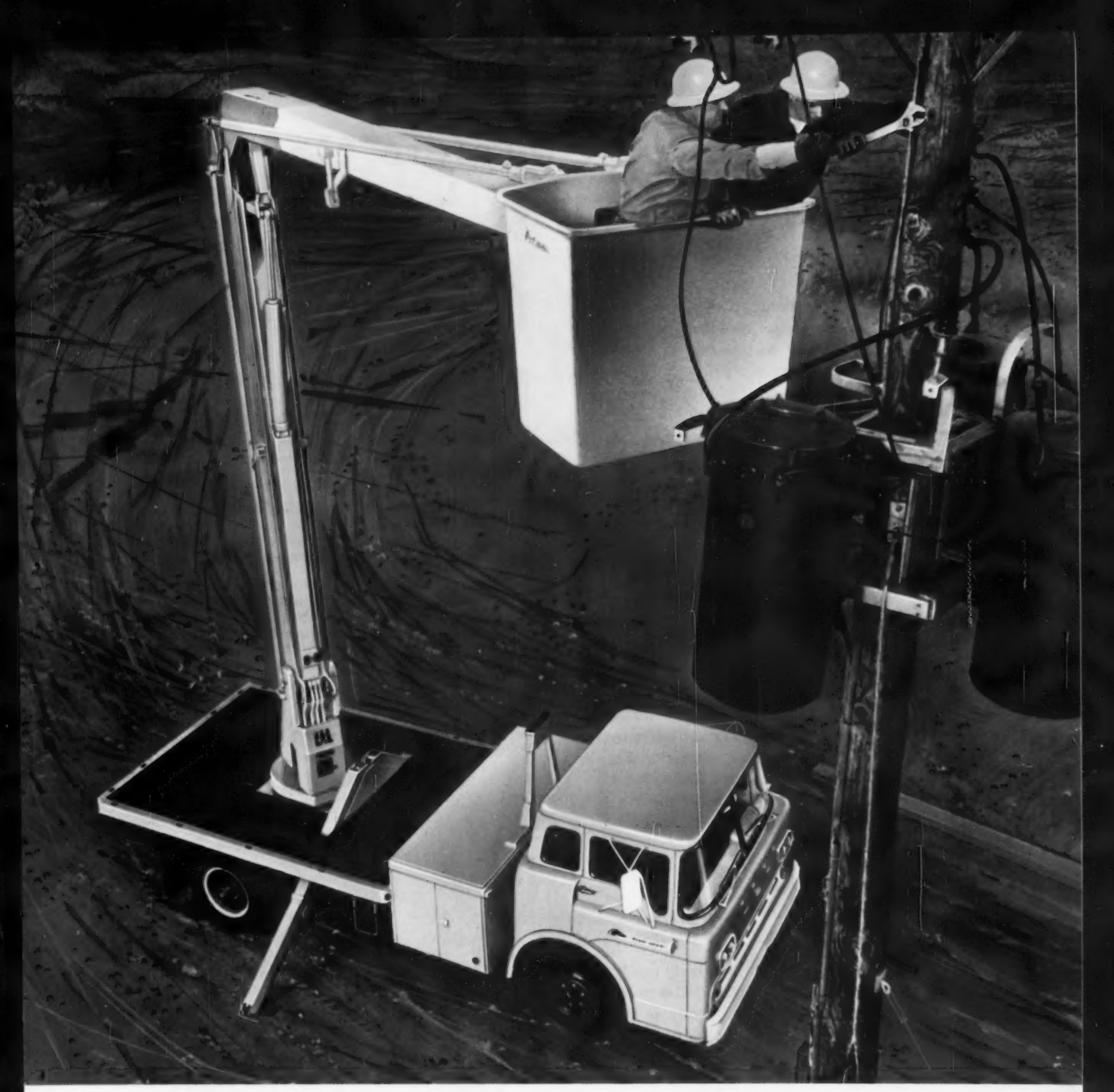
High-precision, high-torque, **electronic transducer** (Dyna-Servo) converts measurement of pressure, liquid level, temperature, and mechanical motion into shaft position for operating transmitting slidewires, alarm switches, analog-to-digital encoders, and deviation contacts.—The Bristol Co, Waterbury 20, Conn.

Electrical **interlock kit** permits field installation of additional contacts in safety switches. The interlock can be used within closed control circuits. It utilizes standard 3-pole switches rather than 4-pole switches.—Square D Co, 1601 Mercer Rd, Lexington, Ky.

Highly-adhesive, epoxy-type **floor patching compound** has improved impact and abrasion resistance. Called RIW Epo-Tox, the compound can be applied in layers as thin as ⅛ in.—Lucerna Co, Inc, 17 E 45 St, New York 17, N. Y.

One-ton **chain hoist,** hand operated, will not free-chain under load, even if the control lever is tripped. With 14-in. handle, the hoist can be operated in close quarters.—Ratcliff Hoist Co, Box 543, Belmont, Calif.

Ultrasonic cleaner (model 260) for applications requiring high energy-density features a 12-gal tank of heavy-gauge, polished stainless steel.—National Ultrasonic Corp, 111 Montgomery Ave, Irvington 11, N. J.



SAFEST MEN ALOFT BY FAR...
in a Pitman Fiberglass Aerial Platform

These men are working in *electrical isolation* from the ground. A pair of bronze bushings is the only metal in the upper boom or basket of their company's new Pitman Fiberglass Aerial Platform. Even hydraulic fluid stops at the "elbow" of the boom! If *you* want to put your men aloft in electrical and mechanical safety . . . on a steady, instantly-responsive Pitman Fiberglass Aerial Platform, you will find it worthwhile to contact your Pitman Utility Equipment Distributor, or simply write us direct.

PITMAN MANUFACTURING COMPANY

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NOW...most complete electrical and mechanical safety

IN A NON-METALLIC PITMAN FIBERGLASS AERIAL PLATFORM*

Hot lines must be maintained without costly "outages," and this reduces the problem to basics: how to put men aloft in electrical and mechanical safety?

To "insulate" an aerial platform is not enough; men must be *electrically isolated* from the ground. Accordingly, Pitman has developed the aerial personnel platform to its highest degree . . . with upper boom and bucket built completely of fiberglass.* Not even hydraulic lines could conduct a charge; there are none in the upper boom.

Tested at 100,000 Volts

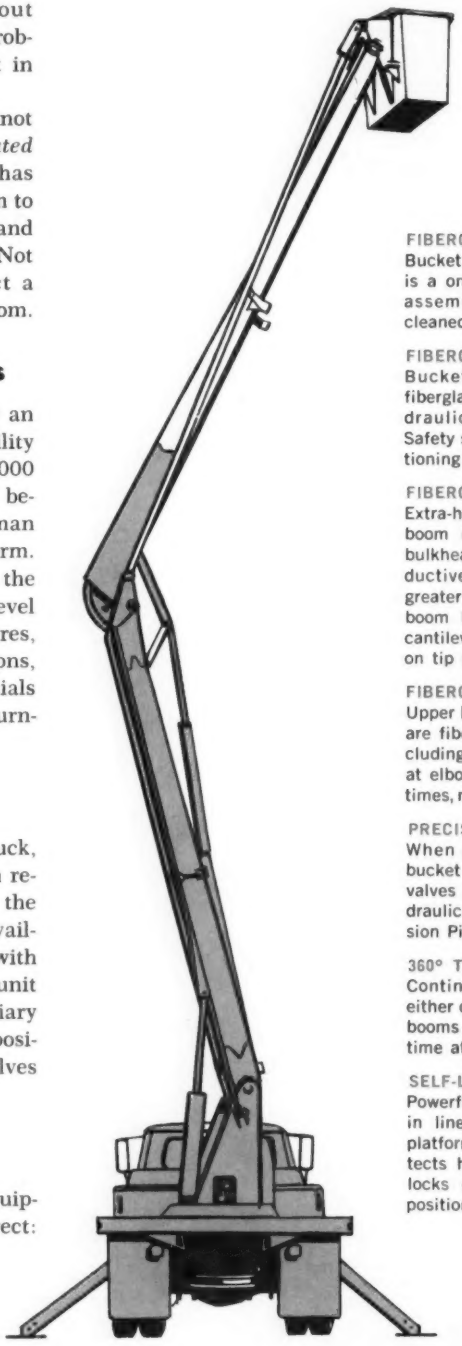
In a series of field tests conducted by an impartial, nationally-known electric utility testing laboratory, a potential of 100,000 volts was applied for three minutes between "elbow" and bucket of a Pitman Model 50-HDF Fiberglass Aerial Platform. Electrical leakage was less than ¼ the amperage needed to reach the lowest level of human perception (0.2 milliamperes, estimated). Under laboratory conditions, the unit has been tested with potentials of 230,000 volts between bucket and turntable without flashover.

A mobile, versatile unit

Mounted on a platform or line-body truck, the Pitman Fiberglass Aerial Platform replaces ladders and climbing irons as the fastest, safest way to put men aloft. Available in 40-, 50-, and 65-foot models with your choice of utility line bodies, this unit operates on power-take-off or auxiliary power package. Lifts 500 lbs. in any position with ample safety. Turntable revolves 360° continuously in either direction.

For full details fast...

Contact your local Pitman Utility Equipment Distributor, or simply write us direct:



FIBERGLASS BUCKET
Bucket and supporting structure is a one-piece polyester-fiberglass assembly; smooth, hard, easily cleaned and extra thick.

FIBERGLASS CONTROLS
Bucket control wheels actuate fiberglass rods which control hydraulic valves in lower boom. Safety stops prevent unstable positioning of bucket.

FIBERGLASS UPPER BOOM
Extra-heavy fiberglass box section boom is reinforced by fiberglass bulkheads and filled with non-conductive "solid plastic foam" for greater rigidity. Fiberglass upper boom has been tested as a full cantilevered beam with 7,400 lbs. on tip end, without failure.

FIBERGLASS LEVELING DEVICE
Upper leveling rods and clevis ends are fiberglass and epoxy resin, including all pins. "Walking beam" at elbow keeps bucket level at all times, no matter how booms extend.

PRECISION HYDRAULIC SYSTEM
When controls are released the bucket stops. Pilot-operated check valves prevent creep, even if hydraulic lines are damaged. Precision Pitman-built cylinders.

360° TURNTABLE DESIGN
Continuous turntable rotation in either direction. Turntable and both booms can be operated at the same time at variable speeds.

SELF-LOCKING OUTRIGGERS
Powerful A-frame outriggers extend in line, provide extremely stable platform. Outrigger housing protects hydraulic cylinders, actually locks outrigger arm in extended position until hydraulically released.

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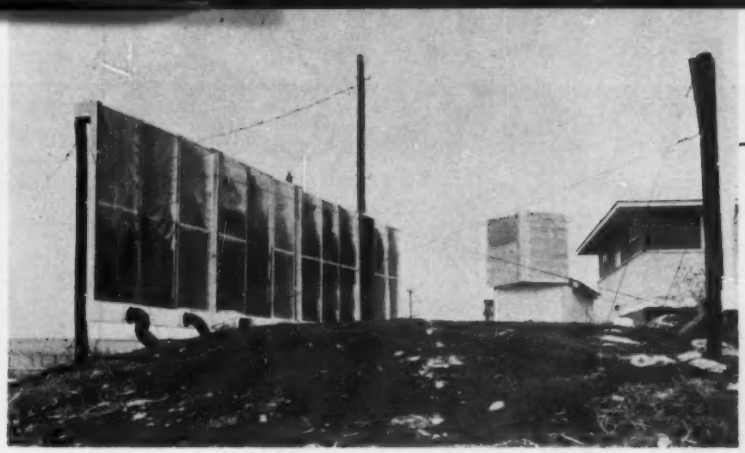


SOLAR HEAT collector, installed at author's home, works with heat pump to increase coefficient of performance

Solar Collector Aids Heat Pump Performance

EARL A. PALMBERG, Sales Engineer,
Kansas Power & Light Co,
Topeka, Kansas.

An experimental installation of a solar heat collector working in conjunction with heat pumps has been in operation in Kansas since Dec. 15, 1959, at the author's home.

These experiments have shown that by using the solar heat trap:

- Coefficient of performance of the heat pump is raised
- Increasing the COP results in greater output by the heat pump
- Number of defrosts of the heat pump is reduced
- In extremely low temperatures, 5F and below, the heat from the solar heat collector keeps the refrigerant flowing through the compressor fast enough so that there is no danger of overheating motor windings. This reduces oil problems in the refrigeration system.

The installation is the outgrowth of a research project conducted jointly by Kansas State University's Department of Agricultural Engineering, the US Department of Agriculture, and the Kansas Committee on the Relation of Electricity to Agriculture. Power companies and the rural co-ops support the latter committee.

Experiments at KSU indicated that the solar collector should result in at least a 20% reduction in energy requirements of the heat

(*Continued on page* 76)

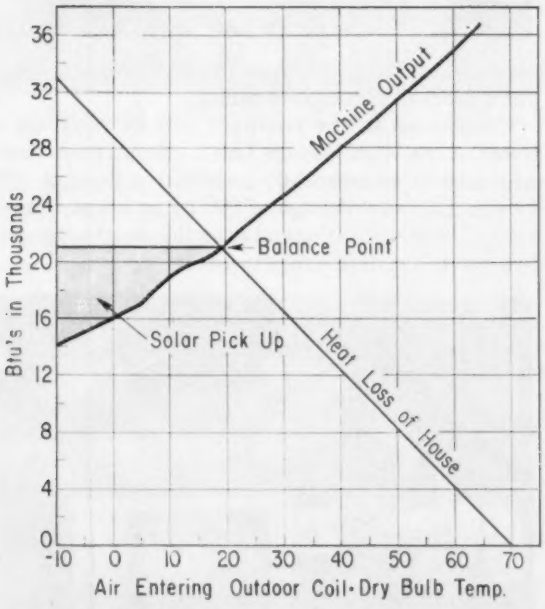


FIG 1—HEAT PUMP OUTPUT varies with temperature of air entering heat pump coil, balances house losses at 19F

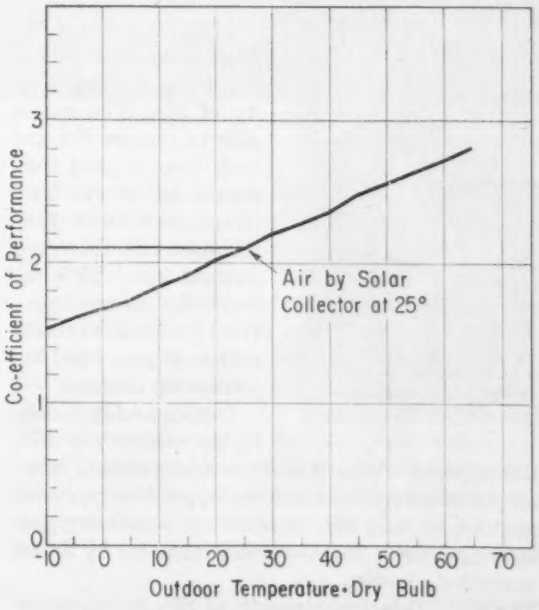


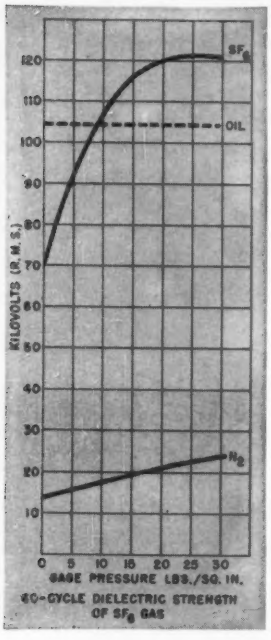
FIG 2—HEAT PUMP COP can be kept above 2 if collector can maintain air to heat pump at 25F or higher

ONE OF A SERIES . . .

Improved safety to system, personnel and equipment provided in new SF_6 gas breaker

. . . improved performance from 69 to 460 kv and beyond

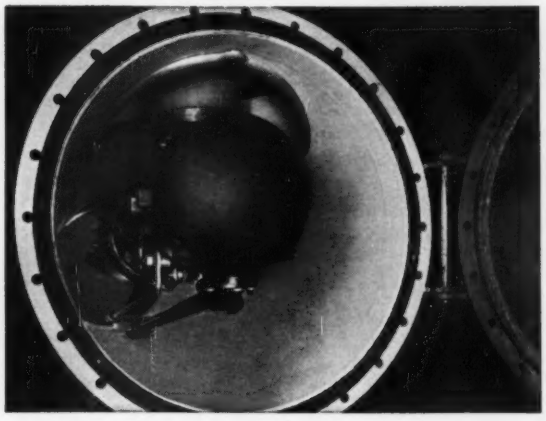
The unusual characteristics of the new arc extinguishing medium, SF_6 (sulfur-hexafluoride) gas, have made possible a power circuit breaker of unequaled safety. For example, a single operating mechanism mechanically connected so that all contacts open and close simultaneously insures reliable relay operation. Additional benefits are found in its dead-tank construction, low, accessible design and an advanced interrupting technique.



Most important for breaker applications is the arc-quenching ability of SF_6. The gas is able to change the arc path from a good conductor to an excellent insulator in a few microseconds following current zero. This remarkable electronegativity characteristic makes SF_6 an ideal interrupting medium.

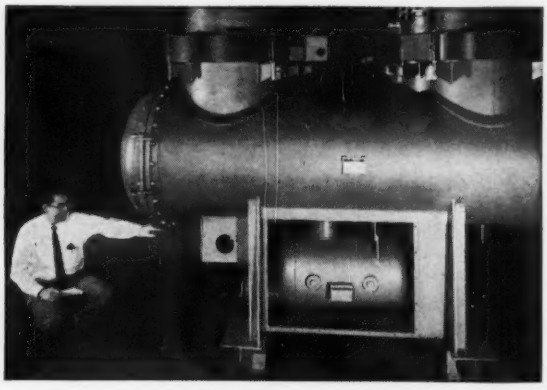
During arcing, a negligible quantity of SF_6 is decomposed. After the arc is extinguished, however, practically all of these decomposition products recombine to form SF_6. The minute remaining gaseous arc products are effectively removed by filters of activated alumina.

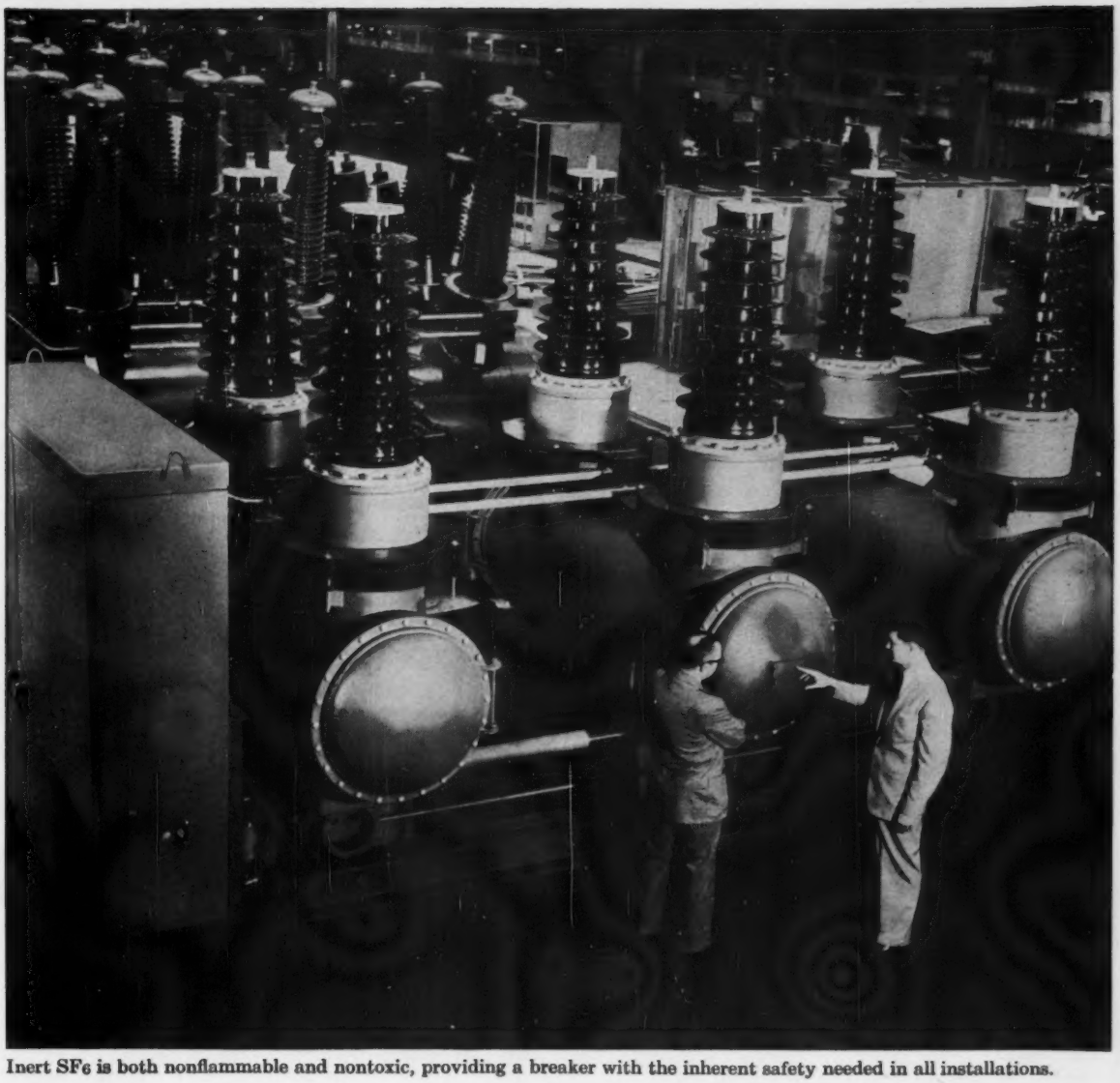
The high dielectric strength of SF_6 at relatively low pressure makes practical a dead-tank design of minimum size and weight. Dead-tank construction



permits operating personnel to work near the energized breaker in complete safety.

Clearances in the compact 230-kv tank were tested at the High Voltage Lab . . . found more than adequate to withstand 60-cycle test voltage of 425 kv and BIL test voltage of 900 kv at normal pressure . . . and still withstand *twice* line-to-ground system voltage at *zero* gauge pressure.

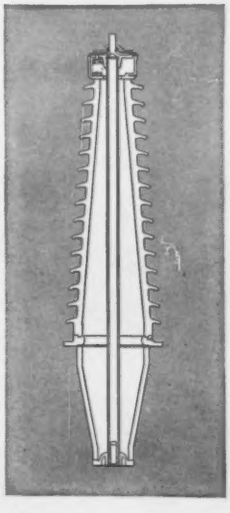




Inert SF_6 is both nonflammable and nontoxic, providing a breaker with the inherent safety needed in all installations.

Use of a horizontal interrupter in the Westinghouse breaker provides another important personnel safety factor. The interrupter is readily accessible at ground level . . . no ladders or scaffolding is needed to make inspections.

In the Westinghouse breaker, current transformers are provided on both sides of each pole. This design makes possible overlapping relay protection. Also, provision is made for mounting two CT's around each bushing. Being externally mounted, they are easily installed.



For the first time in more than half a century, Westinghouse has deviated from its proved condenser bushing design to provide another forward step in the new SF_6 gas breaker. The drawing at left shows the hollow bushing which is open to the main breaker tank and filled with SF_6 gas, a self-healing dielectric. There is no organic insulation to break down. There is no porcelain under high pressure as an added safety factor.

To learn more about the increased breaker life, reduced maintenance and lower installation cost of the SF_6 gas breaker, call your Westinghouse sales engineer. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-61004

Westinghouse

Solar Collector Aids Heat Pump Performance (*Continued from page* 73)

pump. It was estimated that the savings might pay the cost of the solar collector and the heat storage unit in four to five years.

The author's home was selected for the experimental installation because he was building a new home at the time and because of his special interest in heat pumps. An inexpensive type of solar collector was developed through the experiments at KSU. The solar collector consists of two large frames, 9 ft high and 20 ft long, which support corrugated sheet metal painted black and covered with a transparent plastic film. They are located on either side of a crushed rock pit 12 ft wide, 40 ft long, and 3 ft deep. Solar radiation strikes the sheet metal which absorbs the heat energy. Air passing between the metal plates and plastic film picks up the heat.

This heated air is pulled through tubes connected to lateral air ducts on top of the rock. Perforations in these ducts allow the air to be distributed through the rock bed, giving up heat to the rock. A booster fan pulls the heated air to the bottom of the rock pile where it enters a duct leading to the heat pump. The heat pump fan pulls the warm air into the pump.

Rock Storage Acts as Reservoir

On sunny days, heat from the solar collector goes into the rock storage which acts as a reservoir and holds the heat for use during sunless times. During one two-week period of cloudy weather, heated air was drawn almost constantly from storage. At the end of two weeks, air entering the heat pump from the rock storage was still 10 deg warmer than outside air.

The heat pump installation was designed specifically for the purpose of determining the effectiveness of the solar heat collector when used in conjunction with the heat pump. Instead of using one large heat pump there are two 2½-ton heat pumps in the home. One heats the bedroom area and the other is used for the rest of the house. Both units are identical in size and type and carry nearly equal heating loads.

The bedroom area has 1,064 sq ft, with a heat loss of 32,590 Btu, and is located on the north side of the house. This is the zone on which the solar heat trap works in conjunction with the heat pump and is referred to as Zone 1.

The other zone, which consists of the living area, has 952 sq ft and a calculated heat loss of 33,048 Btu. This area is served by the heat pump which does not benefit from the solar heat trap and is referred to as Zone 2.

In order to obtain maximum comfort in the home, a high quality air distribution system was installed. Air wall registers blanket the walls with a protective shield of warm and cold air on the perimeter in an even, soft manner.

Air Changed Seven Times Per Hour

Zone 1 has 12 supply registers and six returns. The air is changed approximately seven times per hour. In general, supplies are low and returns are high.

Fig 1 explains further the effect of the solar trap on the operation of the heat pump. The machine output increases as the temperature of the air entering the outdoor coil increases. The heat loss curve represents the loss in either Zone 1 or Zone 2 of the house; it is either zone because the losses in the two zones are practically identical.

Taking the loss curve for that of Zone 1, where the solar trap is used, it can be seen that the balance point between machine output and heat loss is at an outdoor air temperature of 19F.

In actual operation of the equipment it has been observed that this balance point is nearer 10 or 12F rather than 19F. It has also been noted that the solar trap can supply air at not less than 21F for long periods of time during severe weather. The shaded portion in Fig 1, therefore, shows the solar pick up.

Relative performance of the two heat pumps is shown in the box below. It will be noted that the output of the heat pump having the benefit of the solar heat trap was 23,400 Btu compared to 15,200 for the heat pump without the solar heat trap. The coefficients of performance are 1.9 for the heat pump working with the solar heat trap, compared to only 1.59 for the heat pump working without the solar heat trap.

Fig 2 shows that the coefficient of performance varies with the temperature of the outdoor air, or more accurately the air entering the intake of the heat pump. The coefficient of performance varies from 1.55 at —10F to 2.8 at 65F. If air from the solar collector could be supplied at 25F, the coefficient of performance would remain above two even at outdoor temperatures of —10F.

Each heat pump has a 6.9-kv supplementary duct heater. This heater is energized during the defrost period and at other times when required. The Zone 1 heater operated 50.4 hours in a period when Zone 2 heater operated 230.1 hours. In other words, the supplementary heater on the heat pump operating without any help from the solar heat trap has operated about 4.5 times as much as the one which had help from the solar heat trap.

Heat Output

Outside air temperature	7F
Discharge, outdoor coil, Zone 1	22F
Discharge, outdoor coil, Zone 2	2F
Output, Zone 1	23,400 Btu
Output, Zone 2	15,200 Btu
COP, Zone 1	1.9
COP, Zone 2	1.53

Narragansett Electric Plans Heating Rate

Narragansett Electric Co has made plans for a new electric heating rate.

The plan has been filed with the Rhode Island Public Utilities Division.

Narragansett's rate will be 1.95 per kwhr for all over 400 per month. It was filed to take effect August 1. Edward G. Twohey, Narragansett president, estimated the new rate should permit the average home to be heated electrically for about $300 a year, based on 15,000 kwhr a year.

Terra-Tran FOR RESIDENTIAL APPLICATION

Terra-Tran underground distribution is ideal for residential service. Terra-Tran is the only visible portion of the underground distribution system. There are no poles or guy wires to mar residential landscaping; play areas are free and clear from distractions and hazards. Easily concealed by shrubs and bushes, Terra-Tran actually becomes part of the landscape.

Designed with "child-proof" features, Terra-Tran is completely safe. All high voltage parts and low cost switching devices are completely enclosed in the inconspicuous cabinet. Terra-Tran underground distribution represents utility public relations at its best.

With new installation techniques, you can Terra-Tran residential lots for as little as $150 extra per lot. Savings over the years in operation, maintenance, fewer interruptions, and tree trimming expenses further reduce the figure by as much as $58.

Terra-Tran — pioneered and developed by RT&E — is available in a wide range of single phase ratings, from 15 KVA to 167 KVA.

Write for Bulletin 100 for detailed information on safe and economical methods to Terra-Tran your next residential development.

ENGINEERING TALENT CONCENTRATED ON ONE JOB — A BETTER TRANSFORMER

RT&E CORPORATION WAUKESHA, WISCONSIN
PORTLAND, OREGON
ARLINGTON, TEXAS

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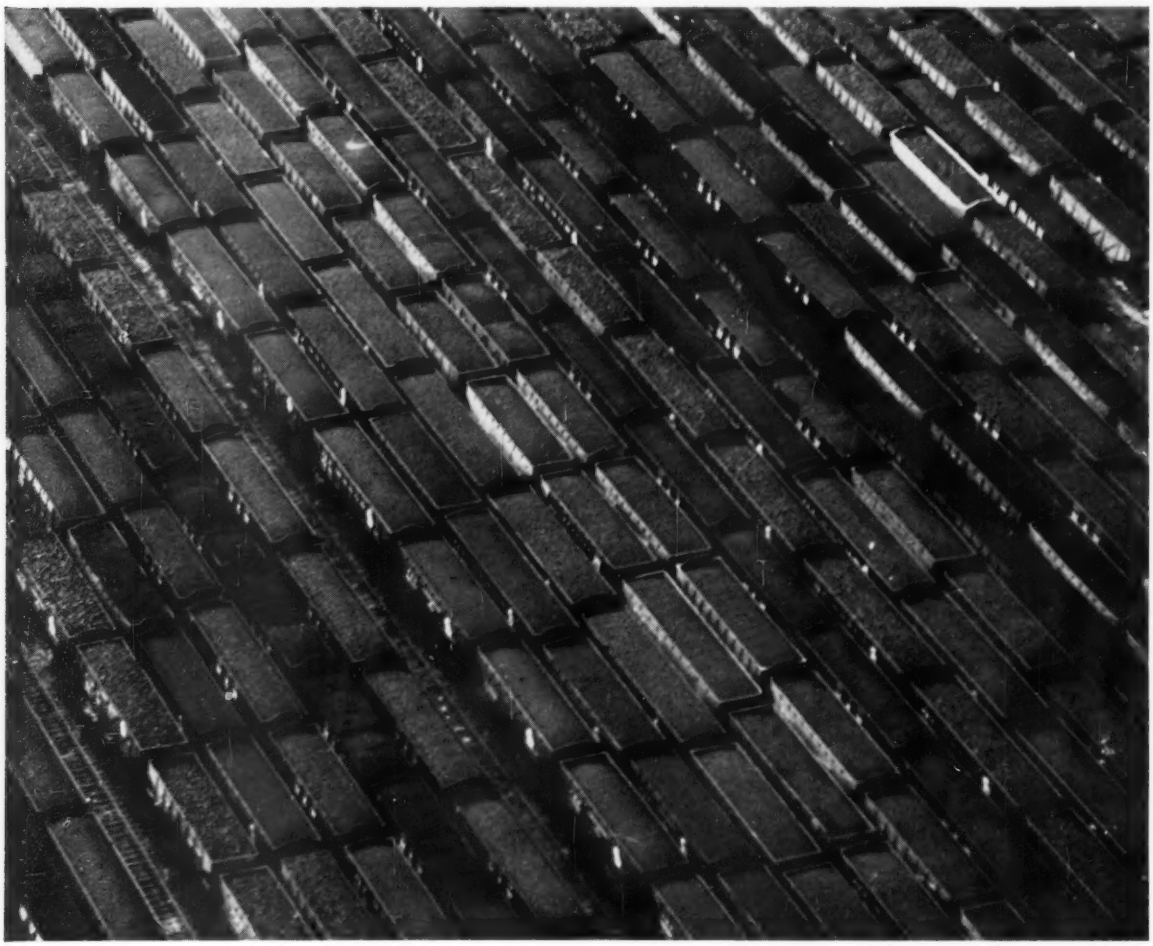
how long?...10 years?...20?...50?

(A utility needs to know!)

There has never been much room for short-term thinking in the utility business. But probably never before have utility executives and engineers been taking *the long look* in so many operating areas.

Take coal, for instance. They've been asking themselves and their coal suppliers some pointed questions: "Can we count on these suppliers to deliver the kind and quantity of coal we're going to need in the years ahead? Have they adequate reserves? Is this coal costing us over and above its invoice price in excessive coal handling, ash handling, equipment outages, freight charges on inerts? Or is it coal that eliminates these frequently overlooked incremental costs, delivers highest operating efficiency and steam at the lowest cost?" The answers you'll get to such questions from Island Creek are the kind that let you plan ahead with confidence. We at Island Creek would welcome a chance to sit down with you for a thoroughgoing discussion. Write, wire or phone.



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N. Y. Chamber of Commerce Probes a Vital Question . . .

What's Wrong With Regulation?

Report on Regulation

"To view the corporation today as the dragon to be slain, or at least kept in irons and fed on a bland diet . . . is obsolete, incorrect, and childish," Professor J. S. Keiper of New York University's Graduate School of Business told the New York Chamber of Commerce last year. "The nature of monopoly has changed," he said, "and we have not sufficiently recognized it in regulation."

Keiper minced few words. So did most of the other authorities who addressed their remarks to the New York Chamber during the past two years. All were contributing to an analysis of the rights and wrongs of utility regulation. The result, just published, is a 42-page study in defense of better service through enlightened free enterprise for the nation's public utilities. Called *Public Regulation of Utility Enterprise,* the booklet finds many serious faults with the nation's regulatory commissions.

Here Are the Chamber's Conclusions:

• **Commissions, too often, are short-sighted.** They sacrifice long-range benefits for short-term advantages, such as temporarily lower rate levels. This runs against the grain of our national growth. As the US economy grows stronger, it can make its decisions with more regard for long range growth, with building a strong base for progress. The thinking of the commissions has generally not kept pace with this increasingly important characteristic of our economy.

• **Utility services are becoming more competitive, less monopolistic.** People have more money than ever for discretionary spending. And many of the new utility services they buy can hardly be classed as necessities. People can air-condition their homes with gas, electricity—or not at all. The point is, new services, and

increments to existing ones, are at the option of the buyer. They are not as essential as, say, pumping or lighting. His decision to buy influences the growth (and therefore unit cost) of utility services. The commissions, generally, have not recognized this important fact.

• **Commissions place too much stress on the bare earnings level** needed to attract new capital. They should also recognize the constructive role profits play in the quality of service the utilities are able to offer.

• **Commissions generally have refused to deal fairly with inflation.** There are a few exceptions. But, by and large, the simple fact that it costs more to do business now than it used to has not been acknowledged by the commissions. A dollar invested in plant or equipment years ago cannot be weighted, one-for-one, with a dollar invested today. Furthermore, historic costs and rates can't be applied fairly to a future period, when investment and costs will undoubtedly be much higher.

• **Commissions have not moved to wipe out trouble spots in the regulatory process.** They have not moved aggressively to urge repeal of restricted or outmoded laws, to urge legislatures to establish clearcut policies, to speed up rate proceedings, or to control excessive zeal for precise measurement. Too often, they say such pioneering is beyond their scope. But they overlook the fact that no group is better qualified than they to do such a job. The commissions were established to bring a degree of expertise to regulatory problems that the lawmakers and the courts could not provide.

• **The commissions have not found a way to reach their decisions** promptly. Regulation lags and lags. And its delay compounds an already complex problem.

• **Some commissions are staff-dominated, and so are their decisions.** But judgment is the job of the commissioners themselves. We urgently need commissioners who are able—and willing—to make their own decisions, the report states.

• **Accusers sometimes judge.** Some staff groups organize and present a case against a utility's request, then advise the commission on its decision, and even assist in writing the opinion. This runs contrary to human nature. A man cannot judge the merits of a case objectively and fairly when he has participated as an adversary. "Due process" means something more than a hearing—it means a fair determination by an impartial arbiter based on fair facts.

• **In a few instances, commissions have been involved in questionable practices.** But to avoid this they should not be rigidly isolated and controlled, the Chamber says. To the contrary: Proper, informal contacts between a regulated business and a commission contribute to mutual understanding, and can help avoid unnecessary delay. The cure for occasional indiscretions lies in appointing persons of high character to regulatory bodies. "Good men can produce better results with a poor law than poor men can produce with a good law."

The critical situation of the railroads since World War II has aroused public interest in regulation, the report noted. Obviously, the entire weight of the rail's plight cannot be laid to unwise regulation. Some carriers are still showing reasonable profits. But if unwise regulation is responsible in part, what does this portend for other utilities? "Under regulation, the credit of the railroads has declined from the highest ranking credit in the US to the lowest," Fairman Dick, widely recognized authority on the economic difficulties of the railroads, told the Chamber. This points up a common worry for all utilities—as inflation continues, the need

to expand investment to serve the public grows more intense. And earnings may actually decline.

This brings the ways commissions determine a "fair and reasonable" return into sharp focus. Are these methods fair? Do they encourage utilities to make a maximum contribution to society? Do they encourage efficient service? The Chamber believes they do not.

There is little doubt that unwise regulation has been one of the major forces that have thrown the railroads into the dire financial straits in which they find themselves. While post-war increases in both passenger and freight rates have been substantial, in most cases they have gone well past the point of no return. It should have been axiomatic that any industry as sensitive to price-consumpion relationships as the carriers should have had small, but frequent, increases, rather than once-in-a-while surges in rates. If the railroads had healthier earnings and realistic depreciation policies, air and truck competition could have been met. Perhaps it could not have been met on an even footing, but certainly not at the tremendous disadvantage the rails face today.

Which Rate Base?

No one can deny that this country has experienced a severe period of inflation. And few persons believe prices will ever return to 1940 levels. In spite of this, many regulatory commissions have refused to modify the original cost concept, and replace it with economic depreciation to account for current costs of property devoted to the public service.

Because depreciation allowances are computed on original cost, amounts being set aside will not provide adequate capital to replace property, the Chamber noted. Thus, the earning power of property replaced through depreciation is often only a small fraction of the original earning power. *The effect of this is a continuing expropriation of the investor's dollar.*

But economic depreciation for accounting and rate-making is not enough, the Chamber might have added in its report. Tax depreciation deductions, too, should be based on the current value concept. Because the Treasury allows tax depreciation only on original cost, many commissions claim economic depreciation is not feasible, since the customer must be charged two dollars to recover one dollar of depreciation—an unjust burden. By the same token, however, it would be very harmful if current-cost tax depreciation were allowed *without* corresponding treatment for accounting and rate setting. The utility's customers would receive all the benefit of the reductions.

Regulation based on original cost usually results in confiscation of a utility's property. This is due, among other things, to its inflexibility. There are two alternatives that would produce fair rates. One, of course, would match current costs of capital against current value of property devoted to the public use. Such rates would, in addition, recover current costs of depreciation. An alternative would be to set rates without any regulation at all (except, perhaps, to control discrimination between groups of customers). Such an idea is not as far-fetched as it appears at first glance. The utilities compete for their customer's dollars along with all other businesses, more so now than ever. The utility that obeyed textbook principles of economics would lower rates to achieve maximum sales—and highest profits. The economic structure of the electric utilities (with about 75% of all costs fixed) makes such a conclusion almost inevitable.

The Role of Profits In Progress

"Regulation is shackled to a rigid 19th Century concept of the power, nature and price policies of a monopoly, an outworn notion of what constitutes a 'necessity' to the consumer, and a distorted negative theory of the cause and function of profit in our society," Prof Keiper remarked to the Chamber.

Profit is a toll on society and, therefore, must be kept to a minimum, says the historical concept of regulation. By thus ignoring profit, we have failed to harness a powerful stimulus to better performance, the Chamber notes. Progressive, well-run companies in non-regulated fields are making a good profit and contributing substantially to the US standard of living. They are meeting their obligations because they combine good profits, good products, and good management. In some ways, their situation is not unique. The economy's impact on regulated industry is the same as on non-regulated industry. All businesses are penalized if they do not offer attractive products at attractive prices. But competition among non-regulated companies stimulates improved performance by offering a profit reward for efficient management.

Among regulated companies, however, there is little reward for improved quality and innovation. In short—there is scant reward for progress.

Cost-Plus Regulation Stifles Initiative

The cost-plus type of regulation runs the danger of stifling the profit motive and actually encourages inefficiency. There's no incentive for improvement if all the profit that results from better management is returned to the customer in the form of short-lived, lower prices. Society benefits more when profits encourage research, innovation, and growth, the Chamber writes. Healthier profits may even go hand in hand with lower rates.

Incidentally, the "healthy profits-low rates" school has some very substantial evidence to back up its seemingly paradoxical claims. In its remarkable study, *Profit, Performance and Progress,* American Telephone & Telegraph Co traced efficiency trends in the industry. AT&T took the 76 largest operating electric utilities in the nation. It split them into two groups—the 36 most profitable companies and the 36 least profitable ones, based on 1956 rates of return.

The AT&T study showed the group of 36 most profitable power companies . . .
- Had operating expenses that were 14% *lower* than the least profitable group,
- Did business with 7% *less plant investment* per 100 kwhr sold,
- Experienced a *sales growth that was* 26% *faster* over the previous ten years,
- *Charged* 4.2% *less for their power.*

Better regulation also means speedier regulation, the report notes. Regulatory lag is a serious economic threat for the utilities. When the costs of business are rising sharply, as they are today, they should be reflected promptly in charges for service. If not, utility earnings deteriorate, with these far-reaching effects: **(1)** It becomes increasingly difficult for a utility to finance its new construction at attractive rates; **(2)** It becomes increasingly difficult to attract equity capital in competition with more profitable, non-regulated businesses; **(3)** It becomes almost impossible for the utility to earn the level of return that the commission originally had found just and reasonable, the Chamber noted.

If we are to read anything into the Chamber's report, it is the need for a united program in the future, a well-known utility consultant has remarked. The electric utility industry should re-examine its relationship with the public at large. Namely, it should reflect on how it got where it is, and on the steps it should take to go where it wants to be.

POWER-INSTALLED SCREW ANCHORS

average 5 to 8 man-minutes for complete installation

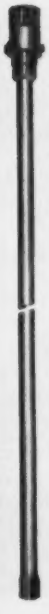
Latest advance in anchoring technique speeds line construction . . . realizes greater value from investment in hole-boring equipment

If your company uses power hole-digging equipment for line construction, you can now use that equipment to install the new line of Chance Screw Anchors.

Chance Power-Installed Screw Anchors, ranging from 78 to 176 square inches in area, can be speedily installed in all types of soil, except extremely rocky soil. Your present power boring equipment, regardless of type, can be easily adapted to power anchor installation. Only one new part is needed—the wrench shown below. This wrench transmits torque from the power equipment directly to the specially designed hub on the anchor helix. Since the anchor rod is not subjected to torque, it only has to be heavy enough to support the guy load—a cost-saving factor.

Installation procedure is extremely simple. *Step one* is to remove the Thimbleye or Twineye nut and slide wrench on the anchor. *Step two* is to fasten the wrench to the "Kelly Bar" of the power-digger, or, to fasten the wrench on the pilot bit of the auger using an adapter. *Step three* is to drive the anchor with the power equipment. *Step four* is to release the wrench from the anchor and retrieve it from the ground. (The spring-loaded "dogs" that lock rod in position are easy to release.) *Step five* is simply replacing the Thimbleye on the end of the rod—your anchor is ready for hooking up the guy wire.

These five steps are accomplished in a matter of minutes. Repeated time tests in various types of soil prove that Power-Installed Screw Anchors averaged only 5 to 8 man-minutes for a complete installation *—from the time the equipment was moved into position until the anchor was ready for the guy!*



THE ONLY PART NEEDED is this special wrench. (Diagram shows how it fits the anchor.) Wrenches are made to fit all popular makes of earth-borers.

THIMBLEYE and TWINEYE guy-wire nuts are available. They distribute pulling stresses uniformly and keep guy wire from spreading, kinking, or bending.

SHARP CUTTING HELIX of high strength structural steel is tapered to minimize earth disturbance. Special hub fits lower part of wrench.

CA59-23B

PULL TESTS PROVE HOLDING POWER

During the engineering and development stages of these Power-Installed Anchors, several hundred tests were made to check the anchoring dependability of power-installed screw anchors. Each anchor was pulled by a mobile testing unit to determine maximum holding power. Complete test data is given in Bulletin 868. Address your Bulletin requests to...

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A. B. Chance Co. of Canada, Ltd., Toronto

FLETCHER TORVINEN PLATH ATCHESON

Sierra Pacific Names Four Vice Presidents

Sierra Pacific Power Co has named Fred L. Fletcher executive vice president, and as vice presidents: Roy Torvinen, treasurer; Neil W. Plath, general superintendent; and Merle H. Atcheson, chief engineer.

Fletcher had been vice president and general manager of the Central Illinois Electric & Gas Co, Lincoln Division. He began with Sierra Pacific in 1928, was with the Nevada State Highway Department from 1933 to 1935, then returned to the power company. Fletcher joined Central Illinois E&G in 1941, where he served as sales manager and as vice president.

Torvinen has been with Sierra Pacific since 1930, which he joined from the Puget Sound Power & Light Co. He has been secretary-treasurer since 1957.

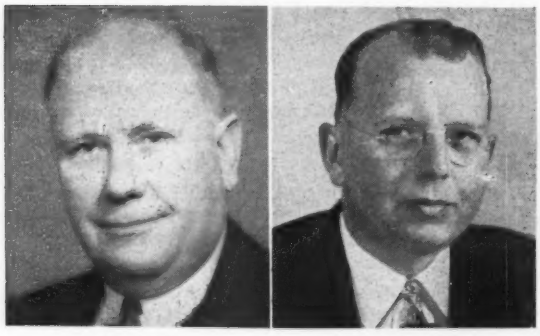
Plath joined the company in 1936 and was made superintendent of construction in 1946. From 1949 to 1958 he was with Stone & Webster Service Corp.

Atcheson has been chief engineer since 1955. He joined the company in 1935 and worked in various engineering assignments until becoming chief engineer.

Moreton Made Chairman of Utah P&L

Fred A. Moreton, Salt Lake City insurance executive and financier, has been elected chairman of the board of Utah Power & Light Co. The president of Fred A. Moreton & Co, he has served on the Utah Power & Light board of directors for 14 years. He was named its vice chairman in 1953.

A 1918 graduate of the School of Military Aeronautics of the Massachusetts Institute of Technology, he is a past president of the National Assn of Insurance Agents.



BERSTED GIESECKE

Bersted Elected President

Alfred Bersted, a pioneer in the manufacture of small electrical household appliances, has been elected president of McGraw-Edison Co. He succeeds Max McGraw who held the post for 60 years, and now has become chairman of the newly formed executive committee. At the same time, R. H. Giesecke has been named executive vice president.

Early in his career, Bersted dealt in electric irons, waffle irons and toasters. In 1933 he acquired the

(*Continued on page* 86)

VOICE OF EXPERIENCE IN DISTRIBUTION/ TRANSMISSION SYSTEMS

When the EBASCO engineer speaks of your distribution or transmission facilities . . . or, when he speaks in terms of your *total* system, of building, of expanding, of managing . . . *he speaks from experience.*

EBASCO has spent over half a century assisting electric utilities chart their courses. This accumulated experience and knowledge within the industry can be invaluable to you, either on an interim or long-range basis.

No problem related to systems is too difficult for the EBASCO engineer. He is thoroughly familiar with methods, equipment, operations and construction, through experience gained on many utility systems throughout the United States and in many foreign countries. He is uniquely qualified to help solve *your* problems of maintenance, replacement, expansion.

Our brochures describe EBASCO's services and how they may be of use to you. For copies, write Ebasco Services Incorporated, Dept. M, Two Rector Street, New York 6, N. Y.

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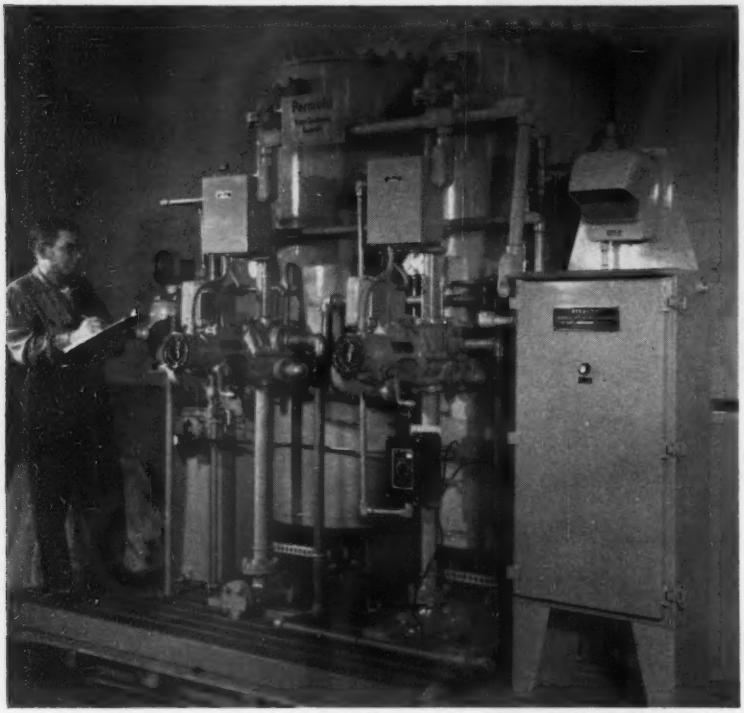
FLUIDICS* AT WORK



Skid-mounted "package" demineralizers available promptly from Permutit

Just connect the influent, effluent and waste lines, and this "package" demineralizer will go to work for you. No field assembly costs, no delays, no capital tied up in construction.

It's one of several demineralizing systems now available as pre-assembled packages from Permutit. They're skid mounted, and most models can be shipped promptly from stock.

You save testing expenses, because these package units are pretested, factory-guaranteed units.

Here are some of the "package" units now available:

12", 15", 20", 24" Mixed-Bed Demineralizers provide flow rates up to 20 gpm (50 gpm for polishing). All of these units are capable of producing demineralized water with an average of over 6,000,000 ohms specific resistance, or about 0.05 ppm dissolved solid content—*all available from stock.*

16", 24", 30" Diam. Single Bed Demineralizers are available as cation exchangers and as anion exchangers—both strong base and weak base. Flow rates up to 30 gpm. All components are carried in stock—permitting prompt delivery of two-bed systems for simple field assembly—or available as a pre-fabricated package, similar to picture above.

Non-Regenerable Demineralizers are available for those applications where it is more economical to discard the resin and replace it than to regenerate it. For example, demineralizers used for radioactive waste clean-up, and for polishing ultra-pure or "ultimate" water, may be of this type. Available from stock.

MBD-6A Mixed-Bed Demineralizer for laboratory use, demineralizes 1 to 2 gpm of water to a low total solids, low CO_2 and low silica content. Unit is 6" in diameter. Available from stock.

More detailed information on Permutit Packaged Demineralizers is given in Bulletin 4721. For your free copy, write our Permutit Division, Dept. EW, 70, 50 West 44th Street, New York 36, N. Y. In Canada, The Permutit Company of Canada, Ltd., 207 Queen's Quay West, Toronto 1, Ontario.

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving problems involving fluids.

PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . . the science of fluid processes

(*Continued from page* 84)

"Eskimo" fan trade mark with the purchase of the United Electric Manufacturing Co. He merged with McGraw-Edison in 1948, became vice president of McGraw-Electric, as it was then known, in 1949, and executive vice president in 1957. In recent years he has been in charge of the company's appliance business.

Giesecke joined McGraw Electric in 1949 as controller and as his first assignment played a large part in the merger with Line Material Co. Later that year he was elected assistant secretary and assistant treasurer. In 1956 he was made treasurer of the company, and later that year, assistant to the president.

PERSONAL BRIEFS

Virginia Electric & Power Co has named **Richard W. Carroll,** director of residential and rural sales, **C. A. Smith** district manager at South Boston, Va., and **William R. Black** sales supervisor at Alexandria.

Roy Stephens has been promoted to Lander manager for Pacific Power & Light Co.

Arthur D. Little, Inc, has appointed **Howard O. McMahon,** senior vice president, **Allen Latham Jr,** senior vice president and **Gustave A. Bleyle,** a vice president.

John G. Johansen has joined the New York office of Eastman Dillon, Union Securities & Co.

The American Institute of Electrical Engineers has appointed **John W. Morrison Jr** student branch coordinator. Seven AIEE members have been advanced to the grade of Fellow for outstanding contributions to the profession: **Ralph H. Earle,** engineering development manager, Line Material Industries Division, McGraw-Edison Co; **George H. Groh,** vice president—research and planning, Arizona Public Service Co; **Howard M. Hess,** associate dean of engineering, Wayne State University; **Harold E. Houck,** senior electrical engineer, and **Cecil C. Saunders,** principal electrical engineer, E. I. duPont de Nemours & Co; **Merrit A. Hyde Jr,** advisory engineer, Westinghouse Electric Corp; and

(*Continued on page* 88)

* CONVERT TO MERCURY IN 1 MINUTE

with New Precision mercury Convertalume

It's a fact. One minute is all it takes to convert any NEMA standard incandescent fixture to mercury. Older fixtures can be converted at the pole with the bracket-mounted Convertalume in just a few moments more.

Either way, the whole conversion job is a simple twist of the wrist. No need to cut wires, buy new fixtures, or remodel old ones. Just slip the Precision Mercury Convertalume into any locking type incandescent receptacle and screw in the mercury lamp. For automated mercury multiple lighting, simply add the fail-proof Precision Multiple Control.

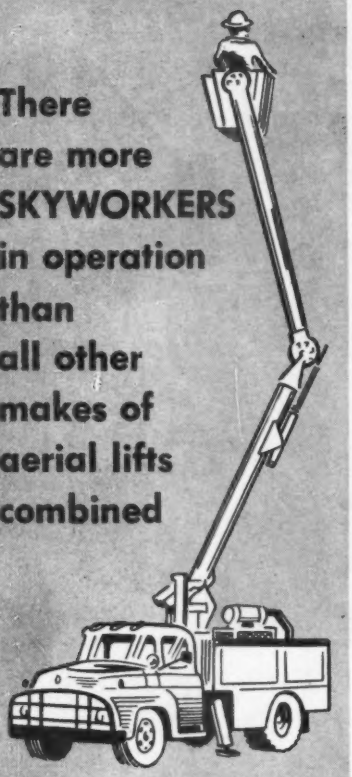
Now every community can enjoy the safest, savingest street lighting ever developed without replacing a single incandescent fixture. Lightest in weight of all ballast combination units, and lowest in cost all three ways — equipment, installation and maintenance — the Precision Mercury Convertalume is also the most attractive unit of its kind. In dimension, satin finish aluminum, and shape it's an inconspicuous matchmate for every standard incandescent fixture on your streets, highways, parkways and whiteways.

Why not give your community the efficiency and economy of mercury conversion — now? Ask your Precision automated light specialist for details on the Precision Mercury Convertalume and Precision Multiple Controls — or write for complete data.

pmc PRECISION MULTIPLE CONTROLS, INC. 233 Chestnut Ridgewood, N.J., U.S.A.

SKYWORKER

There are more SKYWORKERS in operation than all other makes of aerial lifts combined



SKYWORKER

SKYWORKERS cut line work costs 33-1/3% to 50%

Models for all electrical distribution line work, for lamp work and for placing two men aloft. Purchase, lease and lease-purchase plans available.

WRITE TODAY FOR COMPLETE DETAILS

Emhart Manufacturing Co.
Skyworker Division
Hartford 1, Conn.

David F. Tuttle Jr, electrical engineering professor, Stanford University.

Donald P. Terrell has been promoted to public information manager of Toledo Edison Co.

J. Harvey Wilson has retired as superintendent of the Calgary City Electric System and as city electrical engineer. He has been succeeded by **Albert A. Bishop,** former assistant superintendent.

Westinghouse Electric Corp has made the following appointments: **W. M. Chapman** to the new post of general sales manager, Westinghouse International, responsible for coordinating the sales activities of area sales, sales in the US and projects divisions; **David Maxcy Jr** to director of the projects divisions.

Daystrom, Inc, Weston Instruments Division, has named **D. R. MacNaughton** product sales manager for non-contact gauges; **Harold L. Russell,** product sales manager, process instrument sales; and **Ralph L. Shapcott,** to the executive staff of the vice president and general manager.

K. Russell Knoblauch has been appointed market sales manager for the Industrial Products Group, Minneapolis-Honeywell Regulator Co.

Arthur T. Safford has been named to the newly created position of director of marketing for Olin Mathieson Chemical Corp.

Cornell-Dubilier Electric Corp has named **Bob Hart** as marketing manager for the West Coast Division.

Allis-Chalmers Manufacturing Corp has appointed **S. C. Bielawski** purchasing agent, Industries Group; **D. E. Bender,** assistant purchasing agent, electrical section; and **Joseph M. Duncan** assistant general manager, Washington, D.C. office.

M. Frederick Jenny has joined Fischer & Porter Co as manager of the systems engineering department.

Joseph C. Freeland has been named

(*Continued on page* 90)

ANNOUNCING

PENGO-Prope

—the most satisfactory pulling line available today!

* **GREAT STRENGTH**
(9,600 lbs. tensile for ¾" diam.)

* **LIGHT WEIGHT**
(11.7 lbs. per 100 ft., ¾" diam.)

* **HANDLES AND SPLICES LIKE MANILA**
in any climate or weather.

* **WATERPROOF,**
(even salt water) can't mildew; excellent dielectric properties.

PENGO-Prope is a synthetic rope of special construction for pulling line use. Although PENGO has other synthetic and manila pulling lines, we believe PENGO-Prope far surpasses these ropes in cost-saving performance.

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LINE STRINGING SWIVELS

Special models of the well-known MILLER swivels redesigned specifically for tension line stringing use.

The result is a reliable, heavy duty swivel of proper dimensions to pass through stringing sheaves and bullwheel grooves easily, without damage.

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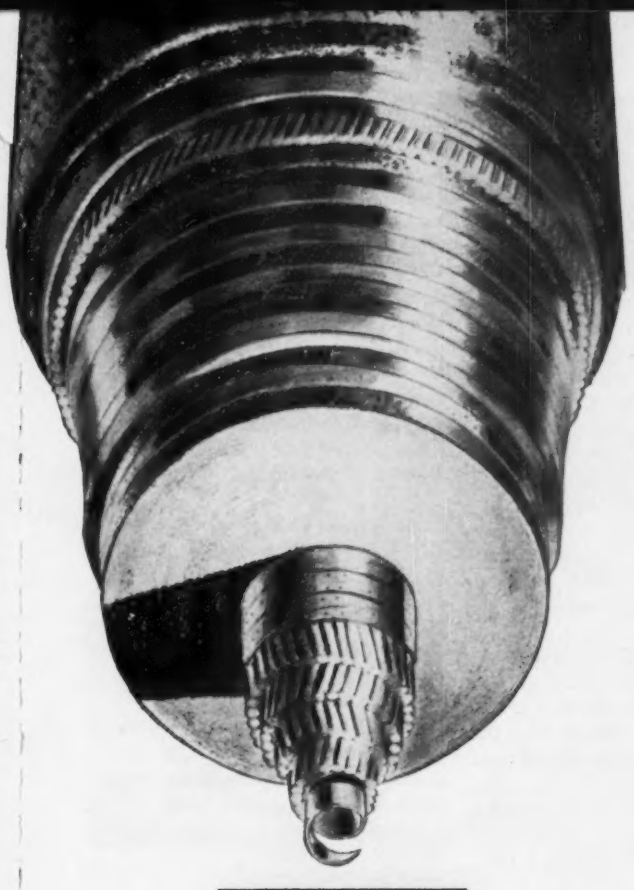


Ascending a 540 foot vertical shaft in the rock, twelve single-core 330,000 volt oil-filled cables link the Kariba power station with the transmission lines above.

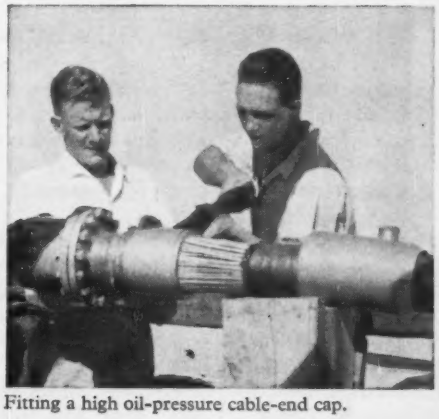
To overcome installation difficulties each cable was produced in a continuous unjointed length, the longest being 665 yards. Total length of 330,000 volt cable supplied —6,718 yards.

These cables, operating at the highest voltage in Africa, were designed, manufactured and installed by the BICC Group.

The Electrical and Mechanical Consulting Engineers : Messrs. Merz & McLellan.

BICC 330,000 VOLT CABLES AT KARIBA

Installing a 330,000 volt cable termination.
(*Copyright : Federal Power Board*)



Fitting a high oil-pressure cable-end cap.

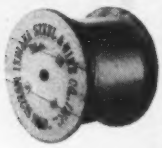
A length of 330,000 volt cable being drawn off the drum.

BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London, W.C.1, England

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

For more than 50 years *Crapo* Galvanized Steel Strand has consistently demonstrated its ability to more than meet all of these requirements. Proof of its reliable performance is to be found in the case histories of overhead power and communication lines throughout the country.

Crapo Galvanized Steel Strand is fully protected against corrosion by heavy, uniform, dense coatings of commercially pure zinc tightly bonded to the individual wires. All grades and sizes are available in A, B and C weights of coating.



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INDIANA
STEEL & WIRE
COMPANY, INC.
Muncie, Indiana

sales manager of Arvin Industries, Inc's Electric Heat Division.

J. H. Hunnicutt has been appointed applications engineer specializing in computer control and monitoring systems for the electric power industry, Thompson-Ramo-Woolridge Products Co.

Allis-Chalmers Manufacturing Co has named **A. D. Foote,** manager of materials, and **R. L. Carlstein,** manager of manufacturing engineering, industries group.

William B. O'Keefe has been appointed Jersey regional manager, Industrial Division, Gould-National Batteries, Inc, and **Richard Relf,** Northeastern regional manager.

Carroll A. Badeau and **Harold S. Berry** have been elected directors of Thomas & Betts Co. Badeau is administrative vice president, and Berry, manager of manufacturing.

Donald F. Hancock has been made assistant sales manager, Power Piping Division, M. W. Kellogg Co.

Arthur J. Conley has been appointed manager of conduit and building wire sales, National Electric Division, H. K. Porter Company, Inc.

OBITUARY

C. H. Edlund, 60, assistant secretary, Consolidated Edison Co of New York, Inc . . . **E. J. Karsten,** chief engineer of Kansas Gas & Electric Co . . . **Thomas H. Carens,** 67, former vice president of public relations, Boston Edison Co . . . **Frank G. Ludvik,** 63, superintendent, meters department, Northern States Power Co . . . **Lloyd G. Mann,** 72, retired assistant secretary and stock transfer agent of Georgia Power Co . . . **L. J. Wilhoite,** 72, chairman of the Electric Power Board of Chattanooga . . . **Louis B. McCarthy,** vice president and treasurer of MacAllen Co . . . **Capt. Clifton G. Grimes,** 57, vice president, Electric Storage Battery Co . . . **Claude R. Lester,** 71, retired chief of the rate and statistics department for Bonneville Power Administration.

SALES ASSIGNMENTS

COMPANY STAFFS

Combustion Engineering Co has established district sales offices in Charlotte, N. C., and Jacksonville, Fla. Weldon Combs has become district manager at Charlotte, and William Clemens is the Jacksonville district manager.

Gould-National Batteries, Inc, Trenton, N.J., has made F. B. Steele Chicago regional manager for the Industrial Division.

Thor Power Tool Co has promoted Paul J. Kennedy to district manager of the Cleveland sales and service branch. With headquarters at 4200 Brookpark Rd, Kennedy succeeds Robert J. Grace, recently appointed Chicago district manager.

D. W. Onan & Sons, Inc, has made two promotions: Frank Ciernia to manager for the five-state upper midwest sales zone; and Willis Erickson as assistant regional sales manager (western).

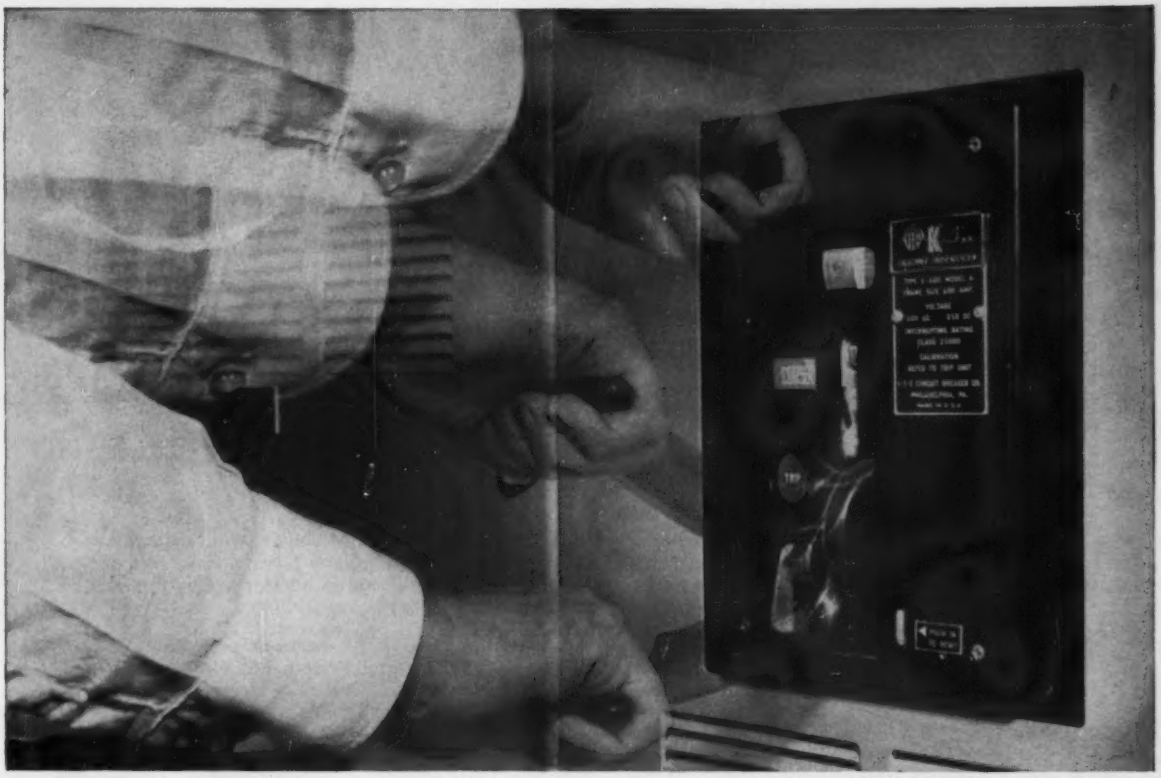
REPRESENTATIVES

General Electric Co has named R. L. Harden to replace L. J. Sacks as eastern district sales representative of the silicone products department. Sacks has become western district sales manager.

Bodendieck Tool Co agent Tom Bowen has formed a partnership with J. Noble Arnold for complete coverage of Florida, with Bowen handling the southern half and Arnold the northern.

Subox, Inc, has promoted Charles R. Bowser to representative in Illinois, Wisconsin, Minnesota, and eastern Iowa. His office is at 1791 W Howard St, Chicago.

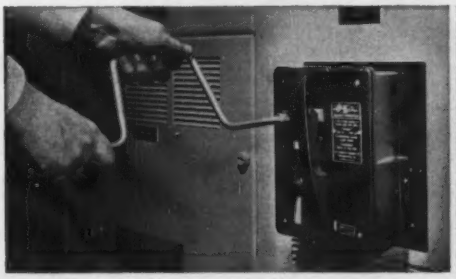
RT&E Corp has made three sales department appointments: Raymond J. Johnson, district representative for Missouri and Illinois, headquartered in St. Louis; John Bagoy to cover Alaska out of Anchorage; and Charles W. Ashby Co, Birmingham, Ala., to represent the distribution, transformer and protective equipment line in Alabama and parts of Florida.



I-T-E started a revolution in 1957 when it introduced the completely new K-Line circuit breaker with stored energy closing. Today it is still the most advanced circuit breaker for low voltage switchgear you can buy.

ONLY I-T-E 600 V. SWITCHGEAR GOES BEYOND STORED ENERGY

GIVES YOU ADVANCES NO OTHER GEAR OFFERS



Closed door disconnect. A real safety feature. Operator can rack breaker out to either test or disconnect position without opening door. Prevents cluttered aisles from open doors and protruding breakers. And keeps breakers clean when they are disconnected.

Expanded range trip. I-T-E breakers can grow with your loads. Each trip device has roughly three to four times the range of conventional devices. Saves cost and downtime that replacement would demand. Easy to adjust. Calibrated directly in amperes.

You pay no more. That's right. With all these extra advances I-T-E low voltage switchgear costs no more. Send for detailed descriptive Bulletin 6004-C. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

From nuclear power to electric energy...

POWERIGHT PARANITE®

POWER CABLE

The new **Enrico Fermi Atomic Power Plant** near Monroe, Michigan, will be operated by Power Reactor Development Company and The Detroit Edison Company for the expressed purpose of demonstrating the practicability of the use of nuclear energy for the generation of electric power. Criticality is scheduled for December 1960.

Paranite Wire and Cable was selected to supply 600 Volt network and 5000 Volt shielded cables for the nuclear section of this major new development. To us it's evidence once again of the nationwide acceptance of Paranite's 70-year record of dependability.

From 600 volt network through 28,000 volt power cable, Paranite's complete line is ready to serve you. If yours is a special application problem the Paranite engineering department invites your inquiry.

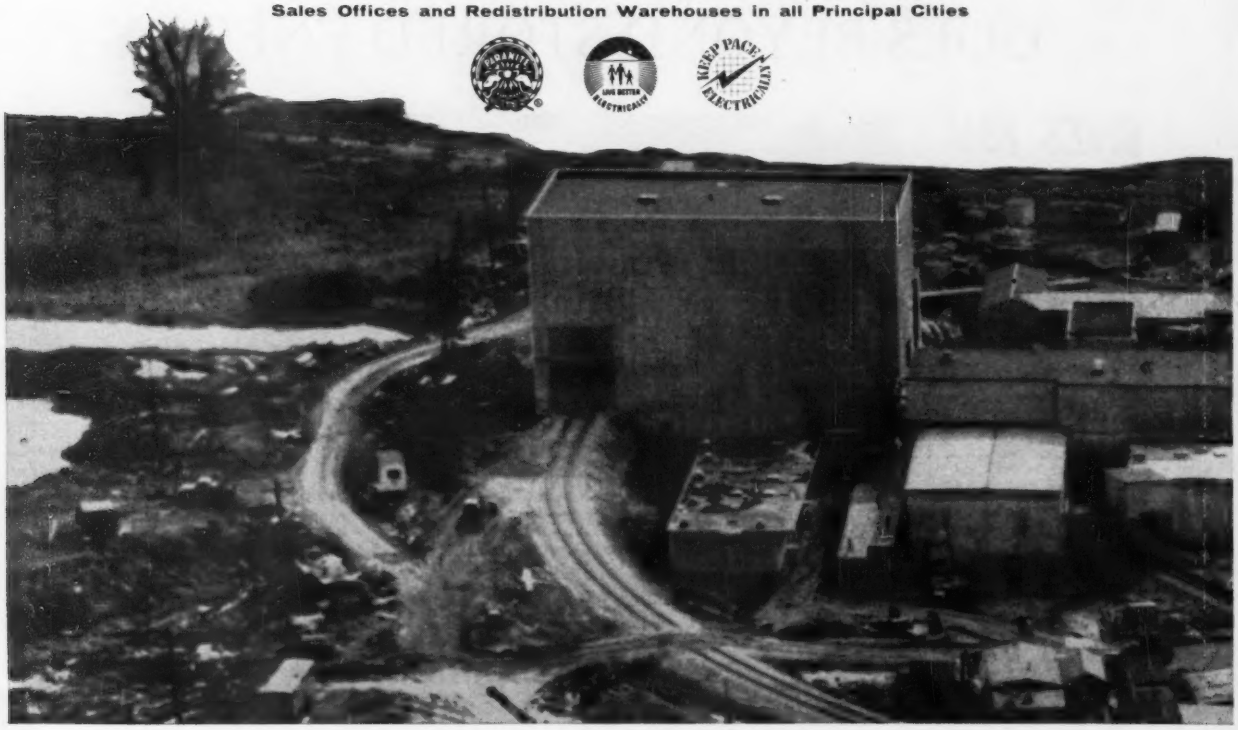
Since 1890

PARANITE WIRE & CABLE DIVISION

ESSEX WIRE CORPORATION, Marion, Indiana

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.

Sales Offices and Redistribution Warehouses in all Principal Cities



A. Paranite **HIGH VOLTAGE CABLES** are manufactured in a complete range of sizes—1000 through 28,000 volt single conductor, 3000 and 5000 volt three conductor. Adaptable for aerial, direct burial or underground duct installation, wet or dry location.

B. Paranite manufactures a complete line of 600 volt **NETWORK CABLES** in gauge sizes through 2,000 MCM. Insulations available include 60°C, 75°C and 90°C types for use in either wet or dry locations.

Discussion of conductor vibration at CIGRE took an ominous turn with reports of very severe vibration damage to ACSR conductors on lines in the southern tip of Sweden. Damage was observed on armor rods and on the conductor within them, in suspension clamps without armor rods, at vibration damper supports, and at ground-wire attachments. Breakage of more than half the total number of aluminum strands have been observed in some cases reported by H. Bovallius, T. Persson and U. Sandstrom, of Sweden.

Terrain a Clue to Vibration

Up to the present the vibration damage has been concentrated in an area of southern Sweden where the terrain is level and the wind velocity low and steady. A number of discussers reported similarly excessive vibration damage on lines in level terrain subject to steady winds of low-velocity. On the Moroccan network, since 1956, damage on lines in similar environment has led to extensive use of armor-grip suspension clamps, R. Girardet reported. N. R. White of Australia reported similar damage on 330-kv lines of the Snowy Mountains project in Australia.

Limiting values of "everyday stress," recommended for the prevention of vibration damage to various conductor types, were contained in an international Study Committee Report by O. D. Zetterholm, Sweden, that met with general acceptance. EDS values were defined as the general order of stress which exists over the larger part of the life of a conductor. Recommended EDS values for ACSR, expressed in percent of ultimate strength, were 18% for unprotected lines, 22% with armor rods, 24% with dampers and 24% with armor rods and dampers. These values reflect results of a limited world survey of practice and experience in EDS and its effect on occurrence of conductor vibration.

Some discussers, notably N. G. Simpson of BICC and N. R. White of Australia, felt values of EDS should be reduced 2-3% per lines in open unprotected country on the basis of excessive vibration encountered on such lines. On the other hand, Dr W. Buckner, of Siemens—Schuckertwerke, emphasized that clamp construction is of vast significance in conductor breakage. Too much attention is being given EDS, he felt, and more research and testing is needed to examine construction of clamps and conductors.

Problems with bundle conductor spacers may be stimulating a return to single conductors. L. Cabanes said Electricite de France is considering such a decision in the case of a 400-kv line in the mountains when frost coupled with vibration and spacer difficulties create a tough combination. Use of bundles grew out of Corona and RI problems, and the time is well chosen to build a single conductor line, Cabanes observed.

Dynamic stresses set up in the unbroken conductor of a twin bundle can go as high as three times the initial stress in it according to model tests described by L. Paris, Societa Edisonvolta of Italy.

Contamination Problem Grows

Most urgent of outstanding problems in the insulation of overhead lines to be discussed at CIGRE was atmospheric pollution—mainly industrial and salt. The problem, an old and familiar one, has been intensified by higher transmission voltages now in use.

Although much effort has been spent in devising methods of alleviating the conditions growing out of contamination of insulator surfaces, little that was new grew out of CIGRE discussion. Changes in insulator shapes, where granulator contaminants are encountered and the coating of insulator surfaces with silicone or petroleum grease to incapsulate contaminants that form electrolytic liquids, and washing, remain the preferred approaches to combating a problem that is well understood but remains unsolved.

Newest design approach to be offered was a solid-core insulator with helicoidal sheds. The lengthening of the leakage path and automatic cleaning properties of this form of shed appears to offer possibilities of solving the pollution problem. The design was described by L. Gion and H. Meier of Compaiguie Genirale d' Electro-Ceramique of France.

J. J. Taylor and A. D. Lantz, Ohio Brass Co, described a test that permits complete exploration of the surge puncture characteristics of porcelain insulators. Use of the test now makes it possible to set design requirements based on an established insulator performance levels. Taylor and Lantz found that insulators are damaged any time single-surge voltage exceeds the longtime puncture strength of 310-kv. This was found to require flashover in 0.084 micro sec, corresponding to a rate of rise of 3,700-kv per micro sec. and permitted establishment of a corresponding criteria for damage free insulator service.

Experience Guides Dc Design

Power system planners are more and more attracted to high-voltage dc transmission, today, by opportunities it offers for asynchronous operation and high capacity long-distance power transfer free of the complications of system voltage, frequency and phase angle.

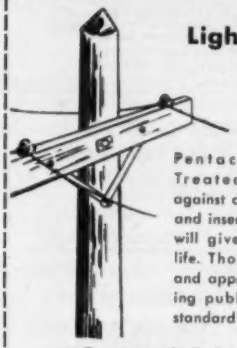
As a consequence, interest in dc is growing around the world. And this was clearly evident at Paris. Next year will see dc cable laid under the English Channel to tie English and French power systems at ± 100 kv and transmit 160 Mw. In addition, Electricité de France is considering a dc submarine cable connection with Algeria under the Mediterranean. Dc links are also being studied in New Zealand, Italy, Canada and Venezuela. Meanwhile, laboratories for experimentation with dc are in operation in Great Britain, Japan, and France.

However, experience with early dc installations in Sweden and Russia is beginning to reveal some unique problems, and it was on these that dc discussion focused at CIGRE. In its first five years, the dc link between Gotland (a Baltic island) and Sweden averaged about 15 faults a year, many related to voltage dividers. But in 1960, so far, these have been cut to one, apparently as a result of the installation of glass-armored polyester plastic voltage dividers, it was revealed.

Performance of the early Kasira-Moscow 70-mile, 30-Mw dc line is

Haley's

CEDAR POLES and FIR CROSS ARMS



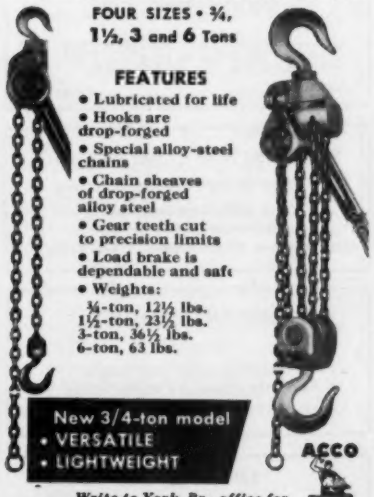
Lightweight!
Strong!
Clear!

Pentachlorophenal Treated—protected against decay, moisture and insect damage, and will give long service life. Thoroughly tested and approved by leading public utilities as standard construction.

• Two strategically located yards
MINNEAPOLIS, MINNESOTA
FINDLAY, OHIO

R. G. HALEY & CO.
SPITZER BLDG.
TOLEDO 4, OHIO

NEW 3/4-ton Pull-A-Way
Added to WRIGHT TYPE "C" LINE!



FOUR SIZES • ¾, 1½, 3 and 6 Tons

FEATURES
• Lubricated for life
• Hooks are drop-forged
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• Load brake is dependable and safe
• Weights:
¾-ton, 12½ lbs.
1½-ton, 23½ lbs.
3-ton, 36½ lbs.
6-ton, 63 lbs.

New 3/4-ton model
• VERSATILE
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ACCO

Write to York, Pa., office for complete information

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York, Pa., Bridgeport, Conn.

CIGRE CONTINUED

guiding design of a 300 mile ± 400 kv dc link from Stalingrad to Donbass that will have a capacity of 750 Mw. M. P. Kostenko, USSR, told CIGRE that radio interference on the early line has been severe and for six miles outside Moscow has exceeded the allowed level. Line overvoltages too are a problem when switching by opening rectifier grids. The trouble led to installation of damping devices.

H. Witt, ASEA, noted that, while switching of lines and loads doesn't cause overvoltages on dc, insulators do have to sustain a continuous voltage and contamination is a problem. Dc requires a leakage path to ground ranging from 2.0 cm per kv, Witt said. Russian experience called for 2.2 cm per kv.

H. E. Forrest, Great Britain, reported three years' study of natural pollution on dc circuits of ± 100-kv using cap and pin, anti-fog, post insulators and bushings. He concluded that, like ac, the phenomenon involves a surging leakage current but is more severe. He recommended use of 30% more leakage distance, or about 4-5 cm per kw. Use of grease on insulators works as well with dc as with ac, as a corrective.

Radio interference on dc circuits can be held to reasonable values by using inductance external to the valves, said R. E. Martin, Central Electricity Research Lab, but warned it won't work well at high frequencies.

A solid-type impregnated paper cable with flexible joints has been selected for the cross-channel dc submarine cable to be laid next May, CIGRE delegates learned. A joint CEGB—Electricité de France paper said impregnated paper was the only insulant reliable enough for voltages above 100 kv. Under dc it will withstand higher stresses than is permissible with ac.

Boost Steady State Stability

Highlight of the System Planning and Operation sessions was a classic paper that analyzed all the methods used so far to increase steady-state and transient stability on the Swedish 400-kv network, including full-scale steady-state tests on the entire Swedish system on Dec. 17, 1959. During these tests

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CIGRE CONFERENCE

(*Continued from page 95*)

the heaviest loaded 400-kv line—400 mi long—carried 850-Mw; the heaviest-loaded 220-kv line, 270-Mw, and the entire transmission system 2,380-Mw.

Among methods employed by the Swedish State Power Board to improve transmission stability and economy, authors B. Nordstrom, L. Norlin, and R. Gradin listed these as most important:

1. Series capacitors made full use of 400-kv lines possible and improved both load distribution between 400 and 220-kv, and reactive conditions.

2. Keeping a maximum voltage on the system even at peak load decreased losses and improved stability more than the cost of reactive needed.

3. Provision of suitable excitation control of alternators.

4. Rapid reclosing of lines.

Because of these measures the most dangerous faults are no longer line, but bus-bar faults. As the network becomes more interconnected, transient stability is less a problem and steady state stability is growing in importance, the authors said.

Steady state and transient stability tests reported by E. B. Powell, W. Mutch, and A. Stalewsky, of England's CEGB, confirmed that turbogenerators run at low load, practically as synchronous condensers, can be operated with a phase displacement above the constant field current limit of 90 deg when a continuously acting voltage regulator is used. Motoring a turbine generator set in this fashion, with steam fed only to gland seals is economic and takes only 15 lb of steam per kva per annum, Powell said.

A new regulator system, for large alternators, that uses rotor angle signals to achieve improved stability protection has been successful on a 60-Mw direct rotor cooled alternator on the British grid. Tests were reported by V. Easton, J. A. Fitzpatrick and K. C. Parton. Russian and Swedish papers also reported effective use of this load-angle signal to achieve high speed voltage regulation and stability of synchronous machines. In fact, the Russians have achieved truly remarkable results with this method, establishing a 730-Mw steady state stability limit for a 400 mile transmission line operating at 420-kv.

Load Frequency Control Grows

For a subject which today is well advanced, load frequency control drew keen interest in CIGRE's section on System Planning. Performance of a new electro-hydraulic turbine governor of high sensitivity on a Norwegian system was reported Most discussers were agreed that wider use of sensitive governors would reduce the work of machines responsible for frequency regulation, lead to new economies operation, and improve network frequency. But it was observed that reduced regulation may put the burden of regulation on machines with the most modern governors.

It was suggested that present regulation is quite satisfactory and that better equalization of individual speed regulation was more important. S. B. Morchouse, Leeds & Northrop Co, reported a case where a dozen or more large identical units gave over-regulation due to simultaneous response, and suggested diversity of response might be desirable. E. B. S. Powell, CEGB, like K. C. Parton of British GE, saw need for sensitive governors on new machines so that, as units get older, advanced systems controls can be applied to future systems.

When interconnected systems have the same characteristics of acceleration time and speed drop, A. Greselin and F. Saccomanno, Italy, pointed out the dynamic responses of frequency and tie line load are completely independent and the control system can be completely determined by a much-reduced number of parameters.

C. Concordia, GE, observed that there was little further need today for the dead band characteristic of mechanical governors. It is to be hoped that load frequency control systems may eventually lead to wider use of electronic governors and the demise of dead bands.

J. K. Dillard, Westinghouse Electric Corp, and H. K. Sels, Public Service E&G Co, described a method for determining the commissioning dates of future steam power plants of a large network that uses operational gaming and Monte Carlo methods to select likely combinations of random events.

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Who's Holding Back Aerial Lifts? (*Continued from page* 44)

must be sold. Others must be sold on the economies and the other contributions that such equipment can make.

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Others, too, agreed that top management might be amenable if acceptance could be obtained down the line.

The discussion came after a show of hands indicated that only 15 of the 30 utilities represented are using aerial lifts, and these counted contractors who are using such devices on company lines. During this discussion, manufacturers received a number of compliments for improving aerial lifts and other devices in recent years. But suggestions were put forward for smaller, lighter booms and buckets suitable for one-man service trucks and aerial ladder replacements.

Several of the utility transportation men urged manufacturers to keep them up-to-date on improvements and developments in the automotive equipment field.

Turning to the use of compact cars in utility fleets, most of the fleet men indicated they had some experience with the smaller, lighter cars. In some cases only a few cars had been brought into fleets for experience purposes. In others, a fairly sizable number had been purchased.

Another indicated a possible saving of $47 per year per car. Several indicated they were not getting as much gas mileage as they had been led to expect. One or two complained about the inconvenience of getting in and out of the cars, but other utility transportation men reported high employee acceptance of the compact car.

Story Is Not Yet In

There was general agreement that the full story is not yet in on compacts. One operator pretty well summed up the reaction when he said, "I don't see how you can expect to fully appraise the feasibility of compact cars in less than four or five years."

One operator argued that for fleet purposes, yearly model changes were not needed. He urged manufacturers of compacts to seek improvements, but not to make model changes merely for the sake of appearance.

Relatively few suggestions were directed toward the manufacturers of truck chassis, but they were cautioned that the chassis must be tailored with utility body mountings in mind. One manufacturer reported a new design for power take-offs said to deliver more power than previous designs.

Still another utility fleet operator reported that his company had brought 300 small foreign van type trucks into his fleet. Experience has shown up some mechanical weaknesses. And there were public relations problems arising from the fact that the trucks were manufactured under government supervision. The utility has stopped further additions of this particular vehicle, but is still interested in smaller service trucks.

Index To Be Available

Title and author index for the Jan.-June 1960 issues of Electrical World will be available after mid-August. As in the past, copies of the index will be sent to libraries and others on our permanent list. Subscribers may obtain a free copy cost by sending a postal card request to: Reprints, Electrical World, 330 W 42nd St, New York 36, N. Y.

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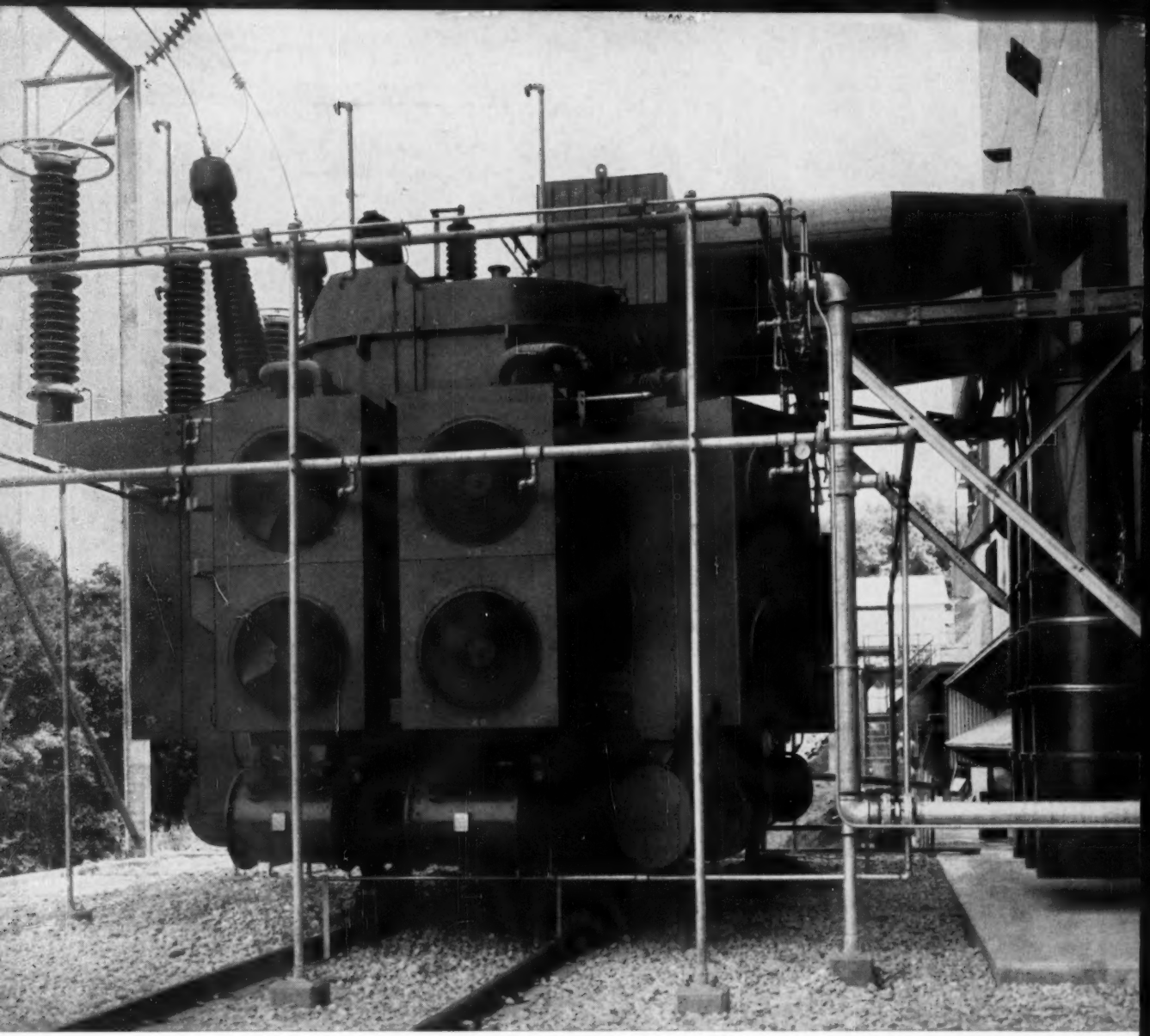

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